Gas Journal

MAY 20, 1936

Vol. 214 88th Year No. 3809

Editorial Notes

The Coal Position

THE Address of Sir David Milne-Watson at last week's Annual Meeting of the National Gas Council was largely devoted to a penetrative review of the present coal situation in its relation to the Gas Industry. On two other occasions last week—at the Annual Dinner of the Society of British Gas Industries and the Annual Meeting of the South-Eastern Gas Corporation—Sir David emphasized in convincing and weighty terms the gravity of the coal position from the Gas Industry's point of view. This is sufficient indication that it behoves every gas undertaking in the country to be ready to resist with every ounce of its influence what, in our view, is a grave menace. The National organizations can be trusted to play their part, but, like the League of Nations, their strength depends upon the loyalty and energy of each of their members.

Let us briefly review once again the position. The Government proposes to place in the hands of the coal industry monopolistic powers far greater than those possessed by any other industry; this is to be achieved by setting up central buying and selling organizations throughout the country with the sole and exclusive right of selling coal, and armed with all the powers of the law to stamp out any form of competition. Since the days of Elizabeth, the very name of monopoly has been regarded with the utmost distaste in this country, and even in those cases where some kind of monopoly has seemed necessary, Parliament has invariably insisted that the rights of consumers should be amply protected. It was in order to ensure that the powers conferred upon water, gas, and electricity undertakers should never be used to the detriment of the community that Parliament has claimed to regulate, if not interfere with, the administration of these public utilities. Obligations to give and maintain a supply of their commodity were imposed upon them, prices were to be controlled in the interest of the public, and they were rigidly prohibited from showing any undue preference or inequality in their dealings with their consumers. Care was taken to preserve the rights of consumers to appeal to the Courts of the Land against any inefficiency or inequality of dealing. The same story may be told of the dealings of Parliament with the Railway Companies, and, in a lesser degree, with road transport.

The coal industry is the vital industry upon which the life of this country depends, and it is proposed to extend to that industry a monopoly more strict and complete than any ever contemplated in our history, and yet no effective statutory obligations or restrictions are to temper the full rigour of that monopoly. Not only is the power of unfair discrimination and undue preference to be unchecked, it is ever expressly authorized. There is to be no obligation to supply coal either of any particular kind or at all, and such price control as exists is essentially in the interest of the suppliers and not of the consumers. There is to be no power of appeal to any competent or judicial tribunal. As we stated last week, the sole right of appeal, unwillingly conceded in the original Act, is to a non-judicial body having no power to order a full and impartial investigation of the facts, no power to make an independent award, and no pretence at representing any but sectional interests.

A Mockery of Justice

THIS was the case that the Conjoint Conference placed before the Secretary of the Mines Department last month; the facts were beyond dispute and were supported by the three great industries of gas, electricity, and water. It might have been imagined that such a case would have impressed a politician who must often have thundered warnings of the dangers of socialism and bureaucratic control. The Minister, however, merely took refuge in the hoary excuse that Parliamentary time was not available for the introduction of legislation.

After such an assurance, what can be said of the introduction within a few days of this Ministerial declaration, of a Coal Mines Bill extending for another five years the very system, with all its abuses, against which the Conjoint Conference had protested. In private life, among decent people, such things simply do not happen. We remember that it took the Gas Industry years of agitation to secure a modicum of legislation for the purpose of removing the more glaring anomalies that obsolete legislation had imposed. After prolonged investigation by many committees, a Bill was introduced on the assurance that it would be a non-contentious measure. Certain recommendations of the Committee, upon which the Industry placed the greatest importance, were denied by the Government on the ground that their incorporation into legislation might arouse some opposition. The Coal Mines Bill is a highly contentious Bill in every detail. It is clear that the coalowners themselves do not want the Bill, and through Sir Adam Nimmo, the Vice-President of the Mining Association, they have called upon the other

industries of the country to support them in their opposition. They have also expressed their views with great vigour to the Minister himself, though their opposition is centred naturally upon the provisions which would force compulsory amalgamations upon them, and not on the powers which are given them to decide what quality of coal a gas undertaking shall be forced to accept, and exactly what price shall be charged for it.

The miners, as represented by the Labour Party, have expressed their dissent. Certainly the large consumers of coal desire to register their hostility in the most emphatic manner possible. Regardless of these considerations, however, the Government are prepared to rush the Bill through Parliament, and the second reading has been fixed for this week presumably in order to render any adequate consideration or discussion of its provisions impossible.

Throughout Europe democratic forms of government have been discarded in one country after another, and Britain is one of the few where any semblance of it remains. If it is the policy of our Government to kill democratic institutions in this country, their attitude to the present Coal Mines Bill is no doubt well founded. It is, however, difficult to understand this attitude if they desire to maintain respect for those great constitutional principles which through the centuries have been built up by our fathers.

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At the moment of going to press, there became available the newspaper reports of the serious difficulties encountered by the Government in the House of Commons on the second reading of the Bill, and of the far reaching changes which, sprung upon the House at the last moment, were the cause of so much bother. The Gas Industry will have noticed that the alterations proposed have no bearing whatever upon the provisions of the Bill which threaten so vitally to affect its interests, and those of its ten million consumers. Two voices were raised in protest against the entire absence of any provision for the protection of the consumer, but the three lines each which, at any rate in *The Times* report of the debate, were allocated to Mr. W. Ross Taylor and Sir Reginald Clarry were insignificant in the volume and weight of speeches protesting against the colliery amalgamation proposals and the iniquity of the Government on general principles. At least the upshot of all the fuss is that an extra day is to be given to the second reading. Can we make any use of this slight respite? See page 481 of this issue.

South Metropolitan Gas Bill

The House of Lords is justly entitled to be regarded as the guardian of the liberties of the subject. If any of our readers doubts this statement we would refer him to the debate in the Upper House on Tuesday, May 12, with regard to the South Metropolitan Gas Bill.

It is well known that one of the objects of this Bill is to authorize the introduction of a meter designed so as to register in terms of therms instead of in cubic feet. It might well have been imagined that this object was harmless enough, especially after some 15 years of experience of the thermal basis of charge. The anomaly that, although the consumer is charged by the therm, his consumption is registered in terms of cubic feet must have puzzled many consumers. Unfortunately, however, the Bill has incurred the hostility of the Board of Trade, a hostility so great that, after its original introduction last session, it had to be withdrawn by the Company. Acting on the long-established maxim that where one did not first succeed one must try, try again, the Company reintroduced the Bill this Session.

The Bill was considered fully and in all its implications by a Committee of the House of Lords presided over by the Marquess of Dufferin and Ava. In spite of opposition from the Board of Trade and the London County Council, the Committee decided in favour of the proposals submitted in the Bill. The true bureaucrat is not, however, to be thwarted by so feeble a thing as a Parliamentary Committee, and the threat was made that if the Bill passed the Upper House, the Government would use its majority in the House of Commons—by the imposition of the Whips—to defeat it. Eventually some kind of compromise appears to have been made under which it is proposed that the Bill should be considered afresh by a Joint Committee of both Houses. As we go to press we learn that it was agreed, on the motion of Sir L. Ward, that a Joint Committee should be appointed to consider whether it is expedient to authorize the measurement of gas supplied by means of meters designed to register in therms.

The Board of Trade is the servant of Parliament, and it is extremely unfortunate that it should not be contented to make its submissions to Parliament and abide by the decisions given in the ordinary course of the passage of legislation into Law. What excuse can be given for the threat to defeat a Bill by the mere machinery of a Government majority, or even for the suggestion that if a decision unwelcome to the Board of Trade is given by one Committee another Committee shall be appointed which, it is no doubt hoped, will be more susceptible to Ministerial blandishments?

Here is a Constitutional issue which dwarfs any consideration of the waste of the money and time of the Gas Company and the taxpayer. The Industry will be grateful to Lord Salisbury for his action in calling attention to this matter, which he described as representing an intolerable position.

The words of the noble Marquess were as follows:

On the last occasion on which it occurred the matter did come under my notice, and I said what I think any of your Lordships would have said under the circumstances. I said that nothing would induce me to give way for a single second in deference to a mere direction from a Government Department. One of the Houses of Parliament to be overridden merely because the President of the Board of Trade or his Emissary thought that we ought to give way, and said: "If you do not give way the House of Commons"—probably a weary House of Commons—"under the orders of its Whips will override you"—that is an impossible position, and I sympathize very much with the noble Marquess (the Marquess of Dufferin and Ava) in the protest that he has made.

York Gas Bill

It is satisfactory to be able to report that the York Gas Bill, the purpose of which is to confer upon the York Gas Company permission to carcass Council houses during the course of their erection, has safely passed through Committee stage in the House of Commons.

It is also a pleasure to us to congratulate the York Gas Company on the action they have taken in appealing to Parliament against an intolerable injustice; and it is to be hoped that their success will be marked in other areas where Local Authorities are still endeavouring to force the tenants of their Council Houses to buy in their own shops.

It is strange that it should be necessary in these days for a Gas Company to incur the expense and labour of promoting a Bill which is merely designed to vindicate the principle which was embodied in the Truck Act over a century ago. The Bill has passed the Committee substantially in its original form, the only material alteration being the restriction of the meaning of the word premises to shops, flats, blocks of flats, warehouses, and

—most important of all—domestic dwelling houses. This modification was to meet the suggestion that the Bill would give the Gas Company power to pipe a Town Hall or any Public Building.

It is unfortunate that the passage of the similar Gas Light and Coke Company (No. 2) Bill has not been quite so simple. Although the Committee found in favour of the principle of the Bill, they had unfortunately omitted to hear certain arguments which Counsel for the Local Authorities interested desired to raise. It has therefore become necessary for the House of Commons to send the Bill to another Committee and the case for the Bill will have to be presented to that Committee *de novo*.

The new Committee propose to commence their hearing this week, and it may be that the precedent obtained in the York Bill will be of considerable assistance to the Gas Light and Coke Company.

The S.B.G.I.

THE Society of British Gas Industries usually manages to make its meetings into happy functions, whether times are good or times are bad. Perhaps " good " times are too much to expect; we never like to think that we are as blessed as were our grandfathers. But apart from the fact that the Society met last week in times which at any rate are less bad than they have been for some years, there were many other reasons making for a sure success.

In the first place the occasion marked the end of the first complete year of what amounts almost to a new lease of life for the Society. We do not mean that there has been any risk for many years that it would cease to function; it has always been too full of vigour for that. But, with the formation of the British Gas Federation, the Society saw for itself a new position in the Gas Industry, in which the co-operation of its own side of the Industry towards the common good was invited to an extent greater than ever before, and the services which the plant and appliance makers have rendered to the general prosperity received, almost for the first time, the recognition which they have merited for generations.

The extent to which the Society has thrown itself into the desired co-operation, and the enthusiasm with which it has answered every call made in the name of the Federation, are now common knowledge, and it is safe to say that, if the Industry does not make a success of the Federation, it is not likely to be the fault of the trading section represented in the S.B.G.I. It has been said many times by its keenest supporters that the Federation must move slowly, and we are certainly not among those who profess to see no movement in it at all. If it aims to go steadily forward, keeping constantly before it the goal of prestige for the Gas Industry, we think that there is a very great deal of useful work for it to do, and that the Industry owes a debt of gratitude to the S.B.G.I. for their very whole-hearted co-operation, without which the entire conception would have come to nought.

The Report of the Council, and indeed the whole account of the General Meeting in other columns of this issue, bear testimony to the co-operation which has already taken place. It is, however, quite a modest testimony in comparison with the general willingness, and indeed determination, to pull their full weight now and in future, which is so clearly expressed in the whole demeanour of the Society and its members. The Industry will be delighted that Mr. D. M. Henshaw has had so highly successful a term of office, though it will certainly realize that much of the success has been due to his own personal effort, and to the enthusiasm with which he throws himself into whatever task comes his way. The number of new member firms joined up during the year easily passes previous records, and the Society will undoubtedly advance to further success under the Chairmanship of Mr. F. B. Richards, with the inspiration of the Presidency of no less a national figure than Lord Londonderry.

Towards Industrial Development

OF special interest and importance at the meeting was the announcement of the re-naming of Section 9 of the Society—hitherto the Gas Engine Section—which now becomes " Industrial Gas Equipment Section." This move is typical of the manner in which the Society is organizing itself to satisfy modern requirements and tendencies, and the better to serve its members and through them our Industry. The interests of quite a number of the firms are almost entirely bound up in the industrial side; and the new move will provide means of indentification and of meeting together to discuss problems of common concern as is the case in other Sections of the Society. It will also provide a basis for communication jointly with users of industrial gas equipment; and we hope and believe that gas undertakings will show their appreciation practically of this further effort of the S.B.G.I. to serve the Industry on really up-to-date lines.

It is, of course, gratifying that this development should have matured in Mr. Henshaw's year as Chairman of the Society. In his Address last November Mr. Henshaw showed keen recognition of the importance of the industrial load, expressing his confidence in the work of the Industrial Development Centres in promoting that measure of co-operation between the equipment maker, the gas undertaking, and the consumer which is the only way in which full and rapid success can be achieved. This co-operation is certain to be fostered by the wise policy of the Society of British Gas Industries in setting up a common platform for joint action. In the past our Industry has given insufficient encouragement to the manufacturer to build, for example, gas furnaces—not only in the matter of suitability of design for the purpose to be fulfilled, but more particularly in the way of offering gas to industry at rates to meet competition from solid fuel and oil. It is, after all, idle to expect a manufacturer to show enthusiasm in the development of gas furnaces, and so on, when he knows at the outset that the rates offered by the gas undertaking are inadequate to counter competition. In the problems of technical design and also in the formulation of rate structures co-operative effort is essential; and the Society has paved the way to render such co-operation effective.

Co-operative Selling

FROM time to time we have emphasized the desirability of co-operative advertising. To our mind co-operative district effort is essential if full value for money is to be gained; upon it much of the future progress of our Industry will depend. An example has been provided by the refrigeration campaign at present in progress. The undertakings covering the greater part of South-Eastern England are working to a single plan, pooling funds for publicity and conducting their sales campaigns on broadly identical principles. Reference to this was made by Sir David Milne-Watson in his Address to shareholders at the Annual Meeting of the South-Eastern Gas Corporation last week. " There is no doubt," he said, " that this procedure has greatly strengthened our hand, and it is already possible for me to say that in the outcome we are going to make very considerable inroads into the great potential market that has awaited us."

In the " JOURNAL " a short while ago we expressed the hope that the refrigeration campaign will be the forerunner of many other co-ordinated district sales campaigns

backed by similar grouping and powerful joint propaganda, and covering in turn many of the other uses of gas in the domestic field. There is no doubt, for example, that more and more efforts are desirable to extend the water heating load, and we should like to see co-operative drives in this direction. We believe that national sales policy will find the best outlet for its activities in the shaping and co-ordinating of district sales policies and campaigns; and in view of this we note with pleasure what Sir David had to say in his Address. The guiding principle of the Corporation in this respect, he observed, will be that co-ordination and rationalization can be applied to the sales side of a group of companies with as beneficial results as they can, for instance, to purchasing and manufacture. Individual undertakings will be left with proper opportunities for the exercise of individual initiative; but there is no doubt that a measure of guidance and inspiration from a central source, ensuring a degree of uniformity in the main lines of sales and publicity work, will be of great advantage.

It is the view of Sir David—and it is our opinion, too—that the same principle of planned and co-ordinated marketing work would yield the same benefits if applied over a wider field. Without financial ties the refrigerator group have come together on the sales side as a matter of commonsense and good business. We commend to the consideration of the whole Industry the principle involved. The adoption by the Industry as a whole of co-ordinated selling and advertising policies would be of enormous assistance on the score of both efficiency and economy. It is, Sir David suggests, " the next great forward step that awaits the Industry." Co-operation in advertising and display means that the force of publicity is enormously increased. People travelling about the districts are continually being brought face to face with the gas story. The more district advertising " catches on," the better. It will make for brighter and more effective propaganda, and will cater for the fact that conditions in different areas vary.

Reorientation of Research

THIS was the subject of a remarkably interesting and characteristically thoughtful Address by Mr. H. Hollings, of the Gas Light and Coke Company, to the Midland Junior Gas Association; the Address is published on later pages of our issue to-day. He pertinently points out that in the discussions of various methods of charging for gas which are of such vital interest in our efforts to promote gas sales in face of competition, it should not be overlooked that the more promotional the tariff the more sensitive does it become to any increase in the cost of making gas; and at a time when the cost of coal and most of the materials used on the works is tending to increase, low costs of manufacture can only be maintained by continual attention to efficiency. Yet there is necessarily a shift of gravity in our programmes of research and technical investigation. The public expects an increasingly high standard of quality in the products we sell, and this applies to coke equally as to gas; and it is essential that we should concentrate on quality of product and hence on improvement of service.

There are two pressing problems in connection with the giving of good gas service. There is the old one of reducing the sulphur content of the gas supplied, and the new one of doing away with gum troubles which, particularly with the development of thermostatically controlled appliances, have cropped up in different areas at different times and in the most perplexing way. Both these problems are considered by Mr. Hollings in his Address. The small quantity of sulphur dioxide in the products of combustion of gas definitely restricts the sale of gas for certain purposes and its corrosive effect shortens the life of appliances. The Author suggests that it might well be worth while, in view of the rapid advances which have been made recently concerning the properties of catalysts, to commence *de novo* a search for a new catalytic process for the removal of carbon disulphide and perhaps of thiophene. One of the essentials of any such new process would be that it should operate at a lower temperature than the existing nickel catalytic process, for it is upon this working temperature that the costs of the process appear largely to depend. It is well known, of course, that benzole recovery by the active carbon process results also in the removal of 80% of the sulphur. The sulphur content of the gas so treated is, in fact, as low as that of gas treated by the nickel catalyst process. Benzole recovery by oil washing is also helpful in reducing the sulphur content of the gas; and it is a matter for investigation to consider how the efficiency of sulphur removal in the oil washing process can be increased. A substantial increase can be effected by circulating a larger quantity of wash-oil, but this entails extra steam consumption in the distillation of the oil. Mr. Hollings mentions, however, that in an experimental plant erected by the Gas Light and Coke Company it is being sought to avoid the excessive steam consumption by operating the still under reduced pressure, the exhaust steam from the vacuum pump being used as process steam.

In regard to gum troubles, it has been shown that, where there is no nitric oxide in the gas, vapour phase gum is not formed. Mr. Hollings explains that recent experiments indicate that when the nitric oxide in crude gas exceeds about 3 parts per million the likely cause is the combustion of air inside the lid of the retort. Here the remedy is obvious. Another observation is that the presence of water vapour has an important effect upon the rate of settlement of any gum particles which may have formed in the gas. At one works where the gas drying plant was moved from the inlet to the outlet of the holder, so that the gas was stored wet instead of dry, the amount of gum in the gas leaving the works during the three months after the change was less than 6% of what it was during the three months before the change.

Forthcoming Engagements

May.

21.—WALES AND MONMOUTHSHIRE ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General Meeting at Monmouth.

26.—W.G.C.—Annual General Meeting at Londonderry House, Park Lane, W. 1, at 3.30 p.m.

26-29.—I.G.E.—Annual General Meeting.

June.

8.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.

9.—I.G.E.—Council Meeting, 10 a.m.

10.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—17th Annual General Meeting, County Hall, Westminster, 10.15 a.m.

16.—I.G.E.—Gas Education Executive Committee, 2.30 p.m.

18.—I.G.E.—Refractory Materials Joint Committee (Stoke-on-Trent), 2.30 p.m.

19.—NORTH OF ENGLAND G.M.A. [AUXILIARY SECTION].—Meeting at South Shields and Paper by Mr. J. R. Porter.

19.—WAVERLEY ASSOCIATION OF GAS MANAGERS.—Annual Meeting at Edinburgh.

23.—I.G.E.—Gas Education Consultative Committee, 2.30 p.m.

24.—I.G.E.—Board of Examiners (Oral Examinations), 9.30 a.m.

30.—SOUTHERN ASSOCIATION.—Annual Summer Meeting.

Coal Situation

Emergency Meeting of the British Gas Federation

A Special General Meeting of the British Gas Federation will be held at the Central Hall, Westminster, S.W. 1, on Tuesday, May 26, at 5.15 p.m., to consider, as a matter of emergency, the coal situation.

Members of the five constituent bodies of the Federation—*i.e.*, The Institution of Gas Engineers, the National Gas Council of Great Britain and Ireland, the British Commercial Gas Association, the Gas Companies' Protection Association, and the Society of British Gas Industries—are requested to attend. The 73rd Annual General Meeting of the Institution adjourns at 5 p.m., thus enabling members to be present at the meeting of the Federation.

Personal

Sir FRANCIS GOODENOUGH, who, as already announced, is relinquishing the post of Executive Chairman of the British Commercial Gas Association at the end of the year, when he will have completed 25 years in that position, was last Friday elected a Director and Vice-Chairman of the South-Western Gas and Water Corporation, Ltd. The appointment is of particular interest to Sir Francis in view of his being a native of Devon. Thus, the nearly fifty years' experience in gas administration and commercial development which Sir Francis has had during his business life, covering many years of active interest in sales management and education for commerce and industry, will not be lost to the Gas Industry and to business generally during the years of his retirement from more active daily work.

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Mr. JOHN G. WRIGHTSON, son of Sir Guy Wrightson, Chairman of Messrs. Head, Wrightson & Co., Ltd., is expected back in London on May 25.

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We understand that Mr. FRANCIS NOEL BOOTH, Chief Assistant Engineer to the Wallasey Corporation Gas Department, has been recommended by the Keighley Gas Committee to be the Borough Gas Engineer in succession to Mr. ARTHUR BROMLEY, who is resigning on account of ill-health. Mr. Booth, who is 41 years of age, was selected from sixty-four applicants. He has been at Wallasey since 1932, prior to which he was for nine years Assistant Engineer to the Rochdale Gas Department. Subject to confirmation by Keighley Town Council, he will begin duty on July 1.

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Mr. ANDREW TRAILL, formerly with the Forfar Corporation Gas Department, has been appointed Assistant Manager at Ayr. Mr. Traill was for a time at St. Andrews, and was appointed to Forfar five years ago.

Obituary

The death is announced at the age of 68 of Mr. A. W. ELLIOT, Assistant Engineer and Manager of the Shrewsbury Gas Light Company for over 42 years. The funeral took place at Cheltenham on May 18.

News in Brief

For Public Lighting the Willenhall Urban District Council have accepted the tender of the Willenhall Gas Company.

Tenders are Invited by the Glasgow Corporation for the removal and replacement of a two-lift gasholder at their Tradeston Gas-Works.

An Application to Borrow £7,500 for the purpose of expenditure on gas mains is being made by the Wigan Gas Committee to the Ministry of Health.

A Reduction in the Price of Gas in Markinch, Fife, of 2½d. per 1,000 cu.ft. is announced by the Markinch Gas Light Company. The contract for street lighting has been renewed with the Company for another six years.

Chemical Engineering Congress.—It has been decided to present every member of the Chemical Engineering Congress of the World Power Conference, to be held in London next month, with a free set of the General Reports.

For Sale by Tender the Stone Gas Light and Coke Company are offering 1,600 5% non-cumulative second preference shares of £5 each at a minimum price of issue of £5 per share. Particulars will be found in our advertisement columns.

Applications are Invited by the Cambridge University and Town Gas Light Company for the position of Engineer and Manager at a commencing salary of not less than £1,400 per annum. Further particulars will be found in our advertisement columns.

An Exhibition, in conjunction with the firm of Gas Appliances, Ltd., was held by the Dukinfield Corporation last week. Each afternoon and evening there were large attendances, which resulted in many orders being booked. The exhibition was opened on Monday, May 11, by Councillor W. Broadbent, those present including Councillor J. Townsley, of Ashton, a Director of Gas Appliances, Ltd. Cookery demonstrations were given by Miss T. W. Sketchley.

A Duty of 30% is imposed by the recent Irish Free State Budget on all gas heating appliances. A new duty of 40% imposed on smoothing irons and stands and on mantel registers does not apply to articles of this description which are heated by gas.

The Tender of Messrs. Gibbon Bros., Dudley, at £7,944 for the reconstruction of four beds of retorts at the Gas-Works has been accepted by the Stockton-on-Tees Council. The steelwork contract and also the extension of the Le Fleuve coke conveyor will be carried out by direct labour. Plans are by Mr. W. W. Atley, Engineer and Manager to the Stockton-on-Tees Gas Department.

Mr. Alex. Tran, Assistant Engineer and Manager to the Bath Gas Company, recently addressed the Bath Rotary Club on "Some Modern Developments in the Gas Industry." In the course of his remarks he drew attention to the progress the Industry had made in respect to refrigeration. "The idea that a refrigerator is only for use in hot weather is being rapidly exploded," he pointed out. He also referred to the progress that his Company had made in respect of amalgamation. The Bath area of supply is now 360 square miles.

Coal as a Sinister Mr. Hyde polluting the atmosphere, sending up the death rate, and damaging property through the medium of smoke, and gas as a beneficent Dr. Jekyll providing mankind with many benefits were referred to by Mr. G. L. Jennings, of the B.C.G.A., when he addressed the Morecambe Women's Citizens' Association meeting at the new Morecambe showrooms on Monday, May 11, on "Public Servant No. 1." Mr. T. W. Barratt, Engineer and Manager, emphasized that no apparatus could be installed in a house and never need attention. He asked them to look on him as the "gas doctor." Mrs. E. H. Clough presided, and Mrs. Barwick thanked the Corporation for the use of the room. Ald. Wilson (Chairman of the Gas Committee) replied, remarking that he had a home fitted throughout with gas.

Midland Association

The Large Group of Visitors to the Northampton Gas-Works on May 7.

Amalgamation and Grouping

Kirkcaldy and Dysart.

The agreement between Kirkcaldy Town Council and the Dysart Gas Light Company, Ltd., for the purchase of Dysart Gas-Works by the Town Council was formally ratified at a meeting of the Town Council on May 11. The price to be paid by the Corporation is £14,225.

South-Eastern and Mid-Kent.

The South-Eastern Gas Corporation, Ltd., announce that their offer to the shareholders of the Mid-Kent Gas Light and Coke Company has been accepted by a substantial majority of the shareholders of that Company.

Gas as an Industrial Fuel

Interesting Address to West Bromwich Manufacturers

The merits of town gas as an industrial fuel were dealt with by Dr. C. M. Walter, Chief of the Birmingham Industrial Gas Department in an interesting Address which he gave to members of the West Bromwich Manufacturers' Association at their quarterly meeting at the Sandwell Hotel, West Bromwich, on Thursday, May 14.

In the course of his Address, Dr. Walter stressed the economic advantages of town gas as a fuel, emphasizing the high efficiency of the application of gaseous fuel with furnaces of modern design as compared with many forms of solid fuel fired apparatus, this high efficiency of application justifying in many instances the use of gas in preference to solid fuel, even though the thermal cost was considerably higher.

After dealing with the developments which have taken place in particular industries in regard to the application of town gas, more especially for such work as re-heating, carburizing, heat-treatment of ferrous and non-ferrous materials, Dr. Walter summarized the advantages of town gas as a fuel.

Dr. Walter concluded by quoting figures to illustrate the increase in the consumption of gas for industrial purposes in Birmingham and said that at the present time no less than 30% of the whole output was being used in factories for industrial and other purposes.

Mr. F. T. T. Hall (Vice-Chairman of the Association) proposed a vote of thanks to Dr. Walter, and this was seconded by Mr. J. Hunter Rioch (Engineer and Manager of the West Bromwich Corporation Gas Department), who took the opportunity of saying a few words regarding the policy of the Gas Committee of West Bromwich in so far as local manufacturers were concerned. Most of them were aware, he said, that some 18 months ago a very attractive scale of charges came into operation whereby gas at as low a figure as 3½d. per therm—according to the quantity used—was now available. He was pleased to say that the manufacturers of West Bromwich were fully alive to the possibilities of future developments particularly in the uses of town gas, and this was shown by the increased consumption during the last year or two.

In conclusion, Mr. Rioch emphasized that the West Bromwich Gas Department was at all times anxious and willing to co-operate with manufacturers in connection with any heat treatment problems.

A Bouquet for Colwyn Bay

Gas at Health Week Exhibition

"Organized for Health," we suggest, would make an excellent slogan for the bracing North Wales seaside resort of Colwyn Bay. Once a year a veritable mass mobilization of the population in the interests of better health occurs. This activity lasts for seven days and is known as "Health Week." Let it not be thought, however, that health is forgotten for the rest of the year, for the Colwyn Bay Health Committee never relax; "Health Week" is merely one of their multifarious tasks and is intended to make the populace "health-minded."

Health Week opened on Sunday, May 3, with addresses at the various churches on health matters. The well-known public health lecturer, Mr. T. Bowen Partington, F.I.L., F.R.E.S., was the principal lecturer. He gave dinner-hour talks at the North Wales Laundry, Colwyn Bay Laundry, Gas-Works, Electricity Works, and the day schools during the week, and also special addresses to members of local guilds.

At the health exhibition the most prominent features included the stand of the Gas Department, which won many deserved compliments for those responsible. But the finest bouquet of all was that from a local newspaper, which ran: "It can be said that a spirit of enterprise and an eagerness to anticipate the needs of the public in the design and scope of appliances, has always characterized the Management of the Colwyn Bay Corporation Gas Department. This has never been more apparent than during the present Health Week, as a visit to the excellent gas display stand will quickly prove. On this stall there is a lady cartoonist connected with the British Commercial Gas Association, who with deft touches illustrates with drawings the advantages of gas-controlled appliances in the home. This is a feature of the stall, and is attracting large audiences. The quality of the work may be judged from the fact that the cartoonist, Miss Grave, recently gave similar demonstrations at Olympia, London."

An Apology to Scotland

In our issue of May 6 there appeared on page 332 an item headed "A Gas Grid for Fife?" which dealt with a number of places actually situated in Linlithgowshire and Mid Lothian. We are indebted to Mr. William Wilson, M.B.E., Director and Technical Adviser, the Caledonian Gas Corporation, Ltd., for pointing this out to us, and we apologize to him and any compatriots to whom our geographical inaccuracy may have caused pain or dismay.

National Gas Council of Great Britain and Ireland

The Eighteenth Annual General Meeting, preceded by the Council Luncheon at which no speeches were made, was held at the May Fair Hotel, London, on Tuesday, May 12. The President of the Council—Sir DAVID MILNE-WATSON, LL.D., D.L.—presided.

The first business was to confirm and sign the Minutes of the Seventeenth Annual General and Special General Meetings held on May 14, 1935.

The SECRETARY then announced the list of Members of the Central Executive Board appointed and nominated respectively by the District Executive Boards and Associated Bodies (Rule VIII., Section I.), as follows:

List of Members of the Central Executive Board, 1936.

Chairman.—Sir David Milne-Watson, LL.D., D.L.

Vice-Chairmen.—Wm. Cash, F.C.A., J.P., F. H. Jones, M.Inst.C.E., Councillor G. H. Kitson, and Alderman J. H. Lloyd, M.A., J.P.

Hon. Treasurer.—Alderman Sir Wm. Kay, J.P.

Hon. Secretaries.—Sir Francis Goodenough, C.B.E., and W. E. Price, A.M.Inst.C.E.

Trustees.—Alderman J. H. Lloyd, M.A., J.P., and John E. Daw, J.P.

Eastern District.—Frank Prentice (Ipswich), R. G. Shadbolt (Boston), W. W. Townsend (Colchester), and J. H. Troughton (Newmarket).

Irish District.—Capt. Geo. Anderson (Queenstown), W. J. Grey, A.C.A. (Alliance and Dublin), J. McNicholl (Cork), and J. D. Smith, M.Inst.C.E., J.P. (Belfast).

London District.—R. W. Foot (The Gas Light and Coke Company), F. H. Jones, M.Inst.C.E. (Wandsworth), W. J. Sandeman (Croydon), and H. C. Smith, M.Inst.C.E. (Tottenham).

Manchester District.—G. S. Frith (Runcorn), J. H. Sillitoe, A.C.I.S. (Manchester), W. J. Smith, B.Sc. (Bolton), and S. Tagg, M.Inst.C.E., J.P. (Preston).

Midland District.—C. M. D. Belton, A.M.Inst.C.E., A.M.I.Mech.E., F.C.I.S. (Shrewsbury), R. J. Milbourne, J.P., A.M.Inst.C.E., F.C.S. (Wellington, Salop, &c.), Alderman T. Mitchell, O.B.E., J.P. (Stoke-on-Trent), and A. W. Smith, F.C.I.S. (Birmingham).

Northern District.—J. E. Blundell, M.Inst.C.E. (Carlisle), H. Lees, A.M.Inst.C.E., J.P. (Hexham), T. P. Ridley, F.C.I.S. (Newcastle-on-Tyne), and F. P. Tarratt, M.Inst.C.E. (Newcastle-on-Tyne).

Scottish District.—G. Braidwood (Coatbridge), Councillor Walter Muter (Edinburgh), J. W. Napier (Alloa), and H. G. Ritchie, A.M.I.Mech.E. (Falkirk).

Southern District.—Chas. F. Botley, M.Inst.C.E. (Hastings), T. Carmichael, M.Inst.C.E., M.I.Mech.E. (Portsmouth and Gosport), Wm. Cash, F.C.A., J.P. (Bournemouth), and A. Valon, M.Inst.C.E. (Bexhill-on-Sea).

South Wales District.—Wm. Clark Jackson, A.M.I.Mech.E. (Neath), W. H. Johns, M.I.Mech.E. (Swansea), J. E. Kenshole (Aberdare), and H. D. Madden, M.Inst.C.E. (Cardiff).

South-Western District.—S. E. Halliwell, F.C.I.S. (Bristol), S. J. Ingram (Truro), Col. R. L. Norrington, C.M.G. (Plymouth), and W. N. Westlake (Exeter).

Yorkshire (W.R.) District.—H. E. Bloor, B.Sc., B.Eng. (York), E. H. Hudson (Normanton), A. L. Jennings (Spenborough), and C. S. Shapley, M.I.Mech.E. (Leeds).

Representing the British Commercial Gas Association.—R. Halkett, Councillor G. H. Kitson, H. Stanley Taylor, and Sir David Milne-Watson, LL.D., D.L.

Representing the Gas Companies' Protection Association.—R. J. Auckland, F.C.I.S., R. W. Edwards, D. H. Helps, A.M.Inst.C.E., and Wm. Phillips.

Representing The Institution of Gas Engineers.—C. Valon Bennett, M.I.Mech.E., Col. W. Moncrieff Carr, O.B.E., T.D., R. E. Gibson, M.Inst.C.E., and J. Terrace, M.Inst.C.E.

SIR DAVID MILNE-WATSON'S ADDRESS.

In rising to move that the Eighteenth Annual Report and Statement of Accounts of the Council for the twelve months ended March 31, 1936, be adopted, I know that in accordance with precedent you will desire to take it as read. A copy has been circulated to all members, and you have, no doubt, made yourselves familiar with its contents. It covers a very large field, and though it is voluminous in extent it does not do more than give a brief summary of the work which has been accomplished during the year. It serves to show clearly, however, how widespread and multifarious our interests are, and how necessary it is that we should have the closest and most active co-operation in order to safeguard them.

Again, in accordance with precedent, I do not propose to comment upon the Report in detail, but to make a short survey of our position to-day, and to refer only to the more important matters which affect our interests.

A Successful Year.

A year ago, looking at our Industry from the point of view of output and business generally, I had to confess that, largely as the result of abnormal weather conditions, results had been somewhat disappointing, and I referred to the efforts which were being made—in particular by encouraging the use of gas for commercial and industrial purposes—to render ourselves as far as possible immune from climatic vagaries. The experience of those undertakings which had adopted the policy of developing sales to industrial consumers showed clearly that such a course brought its reward in the shape of increased output, even though charges had to be cut to secure the business, and the adoption of that policy by others has been a useful factor in securing the somewhat more satisfactory results which have been achieved during the past year. Fortunately, too, the weather has been more favourable from our point of view than it was during the previous twelve months, and, in addition, there has been a steady improvement in trade and industry from which many undertakings have benefited directly. All these factors have contributed to make the year under review more successful from the business angle than its predecessor, and there seems to be no reason to doubt that, provided there is no international upheaval, the improved trade conditions will be maintained during the coming year, and that further stimulus will be provided by the carrying out of the Government's defence programme which affects a very large number of industries. We have in gas a fuel incomparable for industrial purposes, and if we can offer charges on a competitive basis—and let us not forget that we now possess facilities for offering methods of charge suitable to meet the varying needs of industry—we should have no difficulty in securing further business.

Such business may not always be so immediately remunerative as we would desire because, owing to the keen competition with which we are faced, the charges which we must offer to obtain it show only a small margin of profit. On the other hand, it enables us to utilize our works more nearly to capacity and to afford employment to our workers.

While, however, the outlook in that respect is undoubtedly brighter than it has been since the national crisis of 1931, it is unfortunate that it should be clouded in one very important respect—I refer, of course, to the coal position, and I make no apology for proceeding to deal at some little length with a subject which has engaged our anxious attention during the past year, and which is of vital importance to every interest represented by the Industry. Before doing so, however, I wish to mention a

matter having an important bearing upon the internal administration of the affairs of the Council.

Scotland.

Some two years ago doubt was expressed by some of our members in Scotland as to whether the organization of the National Associations at Grosvenor Gardens was sufficiently in touch with the special needs and problems of the Gas Industry in Scotland. It was suggested that some decentralization was desirable, and that a full-time officer resident in Scotland should be appointed to keep Headquarters in closer touch with purely Scottish problems.

As you are no doubt aware, during the past few months Mr. Walker, of the British Commercial Gas Association, has spent a considerable proportion of his time in Scotland, where a special office has been provided for him. He has occupied his time studying the position at first hand and interviewing representatives of gas undertakings, large and small, in all parts of Scotland. I am pleased to say that, as a result, agreement has been reached as to the most desirable steps for securing closer co-operation between our Headquarters in London and Scottish interests, and it is anticipated that our membership in Scotland will be considerably increased. Our Scottish members have always played a useful and effective part in the work of the National Bodies, and it is a great satisfaction to all of us that, by the arrangements proposed, the co-operation which is so valuable from the national point of view will be rendered more mutually advantageous to all our members.

I would like, if I may, to congratulate Mr. Walker on the success of his mission. Speaking as a Scot, I can say without hesitation that he must possess a special gift for diplomacy, in that he—a mere Sassanach—has secured agreement among my ultra canny fellow countrymen.

Coal.

Turning now to the coal position, you will recollect that, in January of this year, the Central Executive Board, under pressure from the Government, recommended all members of the Council voluntarily to increase the price of coal on existing contracts by 1s. per ton in respect of coal delivered under such contracts during the year 1936. One of the conditions attached to this offer was that the aggregate sum so paid should be utilized solely for the purpose of increasing the miners' wages, and we are satisfied that this has been done. A second condition was that a meeting should take place between representatives of the Council and of the Mining Association for the purpose of discussing the unsatisfactory operation of Part I. of the Coal Mines Act, 1930. This meeting took place on March 25, when the opportunity was taken of acquainting the Mining Association with the views of the Gas Industry in this regard.

In order to obtain a clear picture of the position, it is necessary for me to refer briefly to the provisions of Part I. of the Act. In the first place, it was provided, with the object of spreading employment, that the production of coal should be distributed among pits throughout the country, irrespective of their efficiency or working costs. The effect has been to prevent concentration of production at the most economic pits, and consequently to raise the average cost of coal production. Furthermore, the Act permitted the coalowners to charge different prices for identical coal according to the class of customer to whom the coal was consigned. In effect, the coalowners were permitted to ask higher prices of public utility undertakers than were asked of the owners of coke ovens or iron and steel works using identical coal. The coalowners availed themselves of this express authority to discriminate adversely against gas undertakings, and their spokesmen have openly stated that this discrimination is part of their policy and will be exercised particularly against gas and electricity undertakers, who compete with them in the same markets.

It is true that the Act of 1930 established Committees of Investigation before whom an aggrieved consumer might lay a complaint. The machinery provided for dealing with any such complaint is, however, so cumbrous and dilatory that for all practical purposes these Committees constitute no safeguard whatever against unfair discrimination. Even were the machinery to be improved, the personnel of the Committees of Investigation is quite unsuited to the impartial exercise of any judicial function.

District Selling Schemes.

Not satisfied, however, with the results achieved by the operation of the Act, the Government have brought pressure to bear upon the coalowners to establish District Selling Schemes, and have intimated that, with a view to preventing evasions or inter-colliery competition, these Schemes must be so drawn as to cover all the coalowners in each district. One such Scheme covering Lancashire and Cheshire is already in operation, and the Government have informed the coalowners that Schemes applicable to every coal district must become effective by Aug. 1.

The experience which we have gained of the operation of the Lancashire and Cheshire Scheme justifies fully the fears which we entertained in regard to the Government's coal policy. It is a subject upon which I feel it difficult to speak with restraint. Accustomed as we are in this country to a large measure of statutory control being exercised in relation to public utility services such as gas, water, electricity, and railways, the policy being pursued in relation to the marketing of coal appears almost incredible. In effect, the Government are forcing upon the coalowners an unregulated, uncontrolled monopoly in the sale of the country's principal raw material, while depriving the consumer of any effective means of redress should he consider himself aggrieved. The Scheme is the direct antithesis of the policy which over a long period of years has come to be recognized as the method of administering public utility services.

When these Selling Schemes come into operation, no obligation whatever will be placed upon a coalowner to supply any gas undertaking with any particular grade of coal, or, indeed, with any coal whatsoever. Such coal as is supplied may be charged at whatever price the coalowner thinks appropriate, and the consumer will have no opportunity of obtaining supplies elsewhere, because competition as between one coal district and another, and one colliery and another, will have ceased to exist.

As I have already told you, we expressed to the Mining Association our candid opinion of this policy, but we received little more than an assurance that our fears were groundless and that the coalowners would exercise in a reasonable manner the powers with which they were to be invested. I have long experience of coalowners and we simply do not trust them. That is the plain English of it, and I make bold to say that no body of men is to be trusted with a full monopoly. We lost no time in stating our case to the Mines Department, and on this occasion we were accompanied by representatives of the other public utility associations constituting the Conjoint Conference. We pointed out that, as a matter of elementary justice, every District Coal Selling Scheme should contain a clause prohibiting undue preference as between one customer and another on the lines of the provision incorporated in gas and electricity legislation. In addition, we urged that the existing Committees of Investigation should be replaced by some independent and competent Court of Appeal to which immediate application could be made by any undertaker who was aggrieved.

The reasonableness of these claims is so apparent that one would have imagined that it would merely be necessary to draw attention to the omission of these safeguards for the Government to have immediately made good the omission. I regret to say that we received no assurance whatever that our fears would be allayed. The Secretary for Mines stated that no time was available for the introduction of the legislation necessary to give effect to our proposals. He suggested that we should give the operation of the Scheme a trial for a period of, say, twelve months, when we would be prepared to reconsider the position in the light of the experience gained. As I have already stated, our experience of the working of the Lancashire and Cheshire Scheme is sufficient to dispel any hope of gas undertakings securing a "square deal." Prices have already been increased by as much as 3s. or 4s. a ton in the case of coal sold to gas undertakings. Moreover, undertakings have not always been able to obtain the particular type of coal which experience has shown to be suited to their requirements, and they have had to be content to receive at the enhanced price such coal as the District Selling Board thought fit to supply.

Nor is this all, for only last week, without any warning and despite the Minister's statement that no time was available for the introduction of the legislation necessary to meet our wishes, the President of the Board of Trade introduced a Bill which if passed in its present form will keep Part I. of the Coal Mines Act alive till 1942, and thus dash to the ground any hope we may have had that it would be revised next year when it was due to expire. So, notwithstanding all that was said at that interview, they actually have taken the opportunity to put on the floor of the House a Bill not merely dealing with the things that are immediately necessary, but actually extending the operation of this unfortunate and most unfair Act for another 6 or 7 years.

The position is quite intolerable, and though the time at our disposal is short, every effort is being made to organize resistance to the obnoxious portion of the Bill. In addition, it behoves us to use every means in our power to acquaint both Parliament and the public with the facts of the case and the nature of the coal monopoly which the Government are proposing to thrust upon the nation. Of

course, it is not merely the public utilities which will suffer. It is bound to fall on the consumers. Some of you have not advanced the price of gas in consequence of having to pay an additional shilling because you have reserves to draw upon, but there is a limit to that, and in due course any increase in the price of coal must be reflected in the price of gas or electricity. It cannot be otherwise. We have no funds to pay for this extra price of coal, and sooner or later the consumer has got to pay it. That, if I may say so, is the strength of our position. They may not, and probably will not, listen to us as mere public utility authorities and simply as sellers of gas and electricity, but they will listen, if I am not very much mistaken—and I saw it very clearly at that Deputation—the moment you talk of the man in the street and the householder and the effect of the increased price upon him; then they sit up and take notice. All they care about is votes and that is their very weak spot. If we can bring home to them that the consumers of gas and electricity and coal will not stand for this unregulated monopoly, then I think we shall get them to change their tune very rapidly and that is what we are going to devote our energies to in the next few weeks.

There are many other matters dealt with in the Report on which I would like to touch, but to do so would cause me to encroach unduly upon your time. Let me therefore say in conclusion that, despite the obstacles which are thrown in our path, to our detriment and to the detriment of those whom we serve, we shall continue to strive to perform the services for which we are responsible as efficiently and as cheaply as we can, and that if by reason of Governmental action over which we have no direct control we are forced to ask our consumers to pay more for the commodity with which we supply them, the fault will not be ours.

At the conclusion of his Address,

The PRESIDENT moved:

> "That the Annual Report and Audited Statement of Accounts for the twelve months ended March 31, 1936, as circulated, be approved and adopted."

The Accounts.

Mr. WILLIAM CASH, seconding the motion, drew attention to one or two matters concerning the accounts. He pointed out that the year's working showed an excess of receipts over expenditure of £456 compared with £35 in the previous year, and added that this balance made it possible almost entirely to wipe out the deficit brought forward, reducing it to £25. It was also mentioned that the receipts were £2,000 more than in the previous year, which was mainly accounted for by a larger number of undertakings contributing at the higher rate per million cu.ft. of gas made. Commenting on the increase in legal expenses, he explained that this was due to a case which the Council took up on behalf of a gas undertaking which involved an application to the High Courts for a declaration that a restrictive agreement introducing preferential charges was contrary to the provisions of the Electric Lighting Acts, and that case had been brought to a successful issue. There had also been increased legal expenses in connection with the coal position, but several matters dealt with in the Report had been carried through by the Conjoint Conference, and the Council had thus had the advantage of sharing the legal expenses so incurred with electricity and water undertakings so that the total apportionment in this respect was only £175 so far as the Council was concerned. It would be apparent, therefore, that the Conjoint Conference was of very great service to the Council.

To the Joint Finance Committee of the National Gas Council, the B.C.G.A., and the Institution were submitted estimates of expenditure each year, and all three were, of course, anxious that they should be able to carry on the work which they had been doing in the past and even extend it. Therefore, if there were present any representatives of undertakings which were not at present paying on the basis of the full rate he urged, in view of the work being done by all three bodies and the difficult times which had to be faced, that those responsible for these undertakings should, if possible, pay on the full rate in future. An arrangement had been made that the Joint Standing Finance Committee should review the position again in the autumn, and it would be lamentable if the work now being done had to be restricted because of lack of adequate support.

Councillor WALTER MUTER, supporting the motion, referred to the position in Scotland, and expressed the indebtedness of the whole movement in Scotland to Mr. Walker for the admirable services he had rendered, and their thanks to the B.C.G.A. for releasing Mr. Walker for this work. The President had just given a clear and unequivocal lead with regard to the whole position, and it was to be hoped that those in authority would take heed of his weighty words. In the North they had been trying to follow the President's lead with regard to this very difficult position concerning coal. Certain it was that this makeshift legislation of the Government might last for a year or two, or it might last for 10 years, but sooner rather than later this or some other Government would have so to reorganize the mining industry that it was put into a position where it would find its true economic level and basis. The public utilities of this country were entitled to view with no small degree of alarm the tripartite combination that was against them—viz., the mine owners, the mine workers, and the Government of the day, who were in such a state of happy accord that it was impossible not to view the position with some degree of suspicion. It was to be hoped that the work of the National Gas Council and its officers would bear fruit in the immediate future.

Mr. E. PARRY (Oldham) expressed the view that were it not for the voting power in the country there would not have been this trouble with regard to coal prices. In his view the mining industry had been coddled by the Government, but if the Government had said to the mining industry, as it had said to the cotton industry, that it must put its house in order itself, there would have been no increase in coal prices. As things stood at present there were mines in various parts of the country which had been kept alive through the Government's aid. But for that, it would have been possible for the public utilities to buy coal at a reasonable price from those mines which were able to produce it efficiently by being allowed to work at their full output.

Continuing, Mr. Parry suggested that consideration should be given to holding some of the meetings of the National Bodies in the Provinces, say in Birmingham or Manchester.

The PRESIDENT said he had always understood that London was about the easiest place in the world for Provincial members to reach—[hear, hear]—and he really believed that the Industry as a whole preferred that the meetings should be held in London. [Hear, hear.]

The motion for the adoption of the Report and Accounts was then unanimously adopted.

Election of Office Bearers.

Sir CHRISTOPHER CLAYTON then proposed the re-election of Sir David Milne-Watson as President for the ensuing year, recalling that Sir David had been President since the Council was formed in 1919, at a time when there had been a feeling of depression in the Gas Industry. Therefore, they were extremely fortunate at that time in having Sir David Milne-Watson as President of the National Gas Council. Sir David had a personality and a method of dealing with people of all classes in a way which inspired confidence—[hear, hear]—and the result had been that the Gas Industry at the present time was not pessimistic. In spite of the vast sums of money that were being spent by the Government in helping the electrical industry, it was now felt in the Gas Industry that they could hold their own. Admittedly there were serious difficulties in front of the Industry still. There was, for example, the question of coal, and all those interested in the Gas Industry knew full well what a difficulty that was. In all these circumstances they could not do better than take advantage of the willingness of Sir David again to be nominated as President of the Council. He had a very able body of supporters in the Council, and it was with the greatest pleasure that Sir David's name was again placed before the meeting for the Presidency of the Council.

Councillor A. S. GILES (Birmingham) seconded the proposition and remarked that in re-electing Sir David as President they would again be making full use of the best brains and personality in the Industry.

The motion was carried with enthusiasm.

Sir DAVID MILNE-WATSON, expressing his appreciation of his re-election, remarked that this work was indeed a labour of love. If members of the Industry desired to show in a practical way their appreciation of the work which had been done by the National Gas Council, then they would really take heed of what Mr. William Cash had said, and would not grudge the full basis of contribution. They had enemies of all kinds in all directions who were wanting to take away their business. The Industry had a wonderful record in the past, but the only way in which they could hold their position was to see they were properly kept in the limelight, and it was impossible to keep in the limelight without spending money.

Mr. H. STANLEY TAYLOR then proposed the re-election of Alderman Sir William Kay, J.P., as Hon. Treasurer; Alderman J. E. Daw, J.P., and Alderman J. H. Lloyd, M.A., J.P., as Trustees; Sir Francis Goodenough, C.B.E.,

and Mr. W. E. Price, A.M.Inst.C.E., as Hon. Secretaries; and Mr. A. Morland, F.C.A., as Auditor.

Alderman R. TORTINGTON seconded the proposal, which was carried unanimously.

Votes of Thanks.

The PRESIDENT, moving a vote of thanks to the Chairmen and Secretaries of the District Executive Boards, said that an enormous debt of gratitude was owing to these gentlemen, for it was through their efforts that the relationships between Headquarters and the remainder of the country were maintained in the manner they were. At the same time he said he would like specially to mention two retiring gentlemen—viz., Sir William White and Mr. J. W. Napier, who had been responsible for so much good work in Scotland. Sir William had been Chairman in Scotland since 1927, and Mr. Napier had been Hon. Secretary since the Council was formed.

Alderman J. H. LLOYD seconded, and the vote of thanks was enthusiastically given.

Mr. S. TAGG responded on behalf of the Chairmen, saying he was bound to agree that the flexible nature of the Constitution of the Council was due in no small measure to the work done in the various districts, and this had undoubtedly contributed to the success of its work.

Mr. W. W. TOWNSEND, acknowledged the vote on behalf of the District Secretaries in an amusing manner. He added that their enthusiasm would be enhanced by what had been said of them at the meeting, and concluded with a comment on the valuable work done by Mr. Napier.

The PRESIDENT moved a vote of thanks to the Finance and other Committees for their services during the past year.

Councillor G. H. KITSON seconded, and the vote of thanks was cordially given, and acknowledged by Mr. JOHN TERRACE.

The PRESIDENT then expressed the pleasure of everybody at having Sir Francis Goodenough with them again after the severe illness which had caused such great anxiety to all his friends.

Finally, the PRESIDENT moved a vote of thanks to the staff for their loyal services at all times. This vote of thanks, he said, was not a matter of form, for the Council was extraordinarily fortunate in having such a staff with Mr. S. S. Ogilvie, Mr. Fottrell, Mr. Smith, and all those working with them in the office. He doubted whether it was possible to have a more able and assiduous staff, and he asked the meeting to accord them a very hearty vote of thanks.

The vote of thanks was given with acclamation.

Mr. S. S. OGILVIE acknowledged the vote on behalf of the staff, remarking that they were really a very happy family. He felt he had a wonderful staff with him, and they all met with nothing but kindness from the members of the Council. It was a great source of gratification to them all to know that their efforts had earned approval.

The meeting then closed.

Official Inauguration of the Reconstructed Stratford-upon-Avon Works

Gas Committee's Aims

The reconstructed Gas-Works of the Stratford-upon-Avon Gas Department were officially inaugurated on Wednesday, May 13, in the presence of gas engineers from some thirty Midland undertakings. Last week in the "JOURNAL" we published a description of the reconstruction that has been carried out, and gave some details of the new plant installed. Following an inspection of the new Works, the company and members of the Borough Council attended a luncheon in the Town Hall. The Mayor (Councillor G. A. Lea) presided.

Submitting the toast "Stratford-upon-Avon Gas Undertaking," Mr. F. J. West, C.B.E., Chairman of West's Gas Improvement Company, Ltd., congratulated the Mayor and Corporation on their progress and referred to the strides made in the Gas Undertaking during Mr. Shewring's period as Engineer. The sale of gas per consumer at Stratford held a high place among the gas undertakings of the country, and Mr. West noticed that the summer load was very satisfactory, showing that they could depend upon that very essential factor, the domestic consumer, who was the heart and soul of a gas undertaking. Further, the public lighting by gas of the main street—Bridge Street—compared, according to expert opinion, very favourably with the public lighting in London. Mr. West concluded by voicing the feelings of representatives of the Gas Industry present in hoping that the Undertaking in Stratford would continue to prosper and to supply a public utility service which would be advantageous to its citizens.

Alderman F. Ballance, Chairman of the Gas Committee, responding to the toast, said that many services contributed to the comfort and happiness of the people, and those whose job it was to minister to those needs were a very happy band. Referring to the reconstructed Gas-Works, the speaker said that everything was new except the meter and governor house and was of the latest type in every respect. The work had been done by West's Gas Improvement Company, Ltd., Messrs. C. & W. Walker, Ltd., Messrs. W. C. Holmes & Co., Ltd., and Messrs. Newton Chambers & Co., Ltd. They had carried out the work to the Committee's complete satisfaction, and the results of the plant had exceeded the makers' guarantees and the Committee's expectations. Alderman Ballance went on to pay a tribute to the skill and resource of Mr. F. Shewring—a gas Engineer and Manager who knew his job thoroughly and, what was more, did it thoroughly. Alderman Ballance added that he placed most importance on being abreast of the times, and on as many occasions as possible ahead of the times; and above all, on rendering efficient service and giving entire satisfaction to the consumer. These are simple but sound rules and are the lines which the Gas Committee have tried to follow in supplying good gas at a reasonable price—a price which will compare with that in any town in the United Kingdom. And if efficient service, progress, and sound finance were anything to go by, they claimed to have attained some measure of success.

The health of the Mayor was toasted by Mr. R. J. Milbourne (Chairman and Managing Director of Messrs. C. & W. Walker, Ltd.), who thanked the Mayor for his cordial welcome and hospitality. In a tribute to the Gas Committee, Mr. Milbourne remarked that Alderman Ballance and his colleagues worked with the enthusiasm of a paid board of Directors.

Responding, Councillor Lea said that they were proud of their successful Gas Undertaking at Stratford, especially from the ratepayers' point of view.

The health of Mr. Shewring was toasted by the Mayor, who spoke in appreciation of his efficient services.

Mr. Shewring thanked the Mayor and the company for honouring him and took this, the first opportunity he ever had, of publicly thanking Alderman Ballance and the Committee for the help they had always given him. He also spoke in appreciation of the co-operation of Mr. F. J. Symons (Assistant Works Superintendent).

Successful Dorchester Demonstrations

Gas Fires as Prizes for Cake Baking

The housewives of Dorchester turned up in force at the recent successful demonstrations held by the Dorchester Gas and Coke Company at the W.I. County Hall.

The demonstrations were given in an excellent setting by Miss R. M. Thring, N.C.D.S., of the Radiation Research Kitchen. These attracted considerable attention, both in the local press, where they were hailed as a "school for modern cooks," and among the townspeople, who turned up to the number of 1,500.

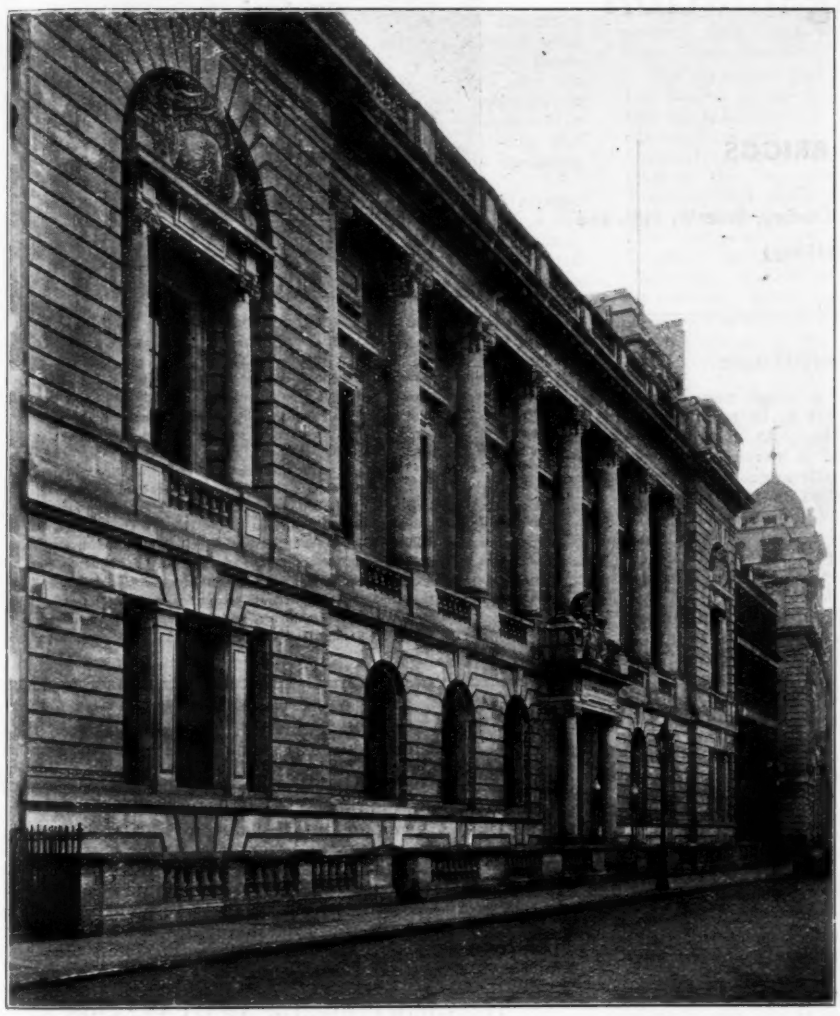
At the concluding session, the Mayor of Dorchester, Mr. F. C. James, addressed the audience and then proceeded to present the successful entrants to the cake-baking competition with the awards made by the Company. These included a "High Beam" gas fire and other useful appliances.

Replying to the Mayor, Major H. O. Lock, Chairman of the Dorchester Gas and Coke Company, spoke of the harmony that existed between the Company and the Corporation. Referring to the success of the exhibition, he said the attendance of just over 1,000 last year had been improved upon, and this year's attendance was 1,500. He hoped at the next exhibition the attendance would increase again. He went on to thank Mr. Robert Morton, Engineer and Manager, Mr. A. C. Treavis, Secretary, and Mr. G. Wright and all the staff for their services in making the exhibition a success. He also thanked Miss Thring and the other demonstrators.

Miss Thring replied on behalf of the demonstrators.

Mr. Morton replied on behalf of the staff of the Company. He said the members of the staff had great pleasure in doing all they could to make the exhibition a success.

THE INSTITUTION OF GAS ENGINEERS' ANNUAL MEETING



The Venue of the Meeting. *Photo. by Bedford Lemere.*

May 26 to 29, 1936

The business sessions will be held in the Great Hall of the Institution of Civil Engineers, and through the courtesy of that Institution we are able to publish here a photograph of their Headquarters in Great George Street, S.W. 1

President :
Colonel W. MONCRIEFF CARR, O.B.E., T.D., of Stretford.

The "JOURNAL" Abstracts of the Communications

A full report of the discussions on the Papers will appear, as usual, in our Second Institution Number on June 3.

In the following pages are abstracted the Papers to be presented at the 73rd Annual General Meeting of The Institution of Gas Engineers, to be held in London next week under the Presidency of Colonel W. Moncrieff Carr, of Stretford.

(Communication No. 131)

The Dudley Gas Amalgamation

by

FRANCIS C. BRIGGS

(Engineer and Managing Director, Dudley, Brierley Hill, and District Gas Company)

[*Photo. by Lafayette.*

F. C. BRIGGS.

After a preliminary training in general engineering in London, Mr. F. C. Briggs entered the Gas Industry in 1909 as a pupil with the Gas Light and Coke Company. On the completion of his indentures he was appointed to the Engineering Staff of this Company. In 1916 he took up the position of Engineer and Manager of the Dudley Gaslight Company, and subsequently Engineer and General Manager. In 1931 he became Engineer and Managing Director of the Dudley, Brierley Hill, and District Gas Company, which position he still holds. Mr. Briggs was President of the Midland Association of Gas Engineers and Managers from 1926 to 1928 and Chairman of the Midland Commercial Gas Association from 1932 to 1936. He is a member of the Gas Education Executive Committee and of the Executive Committee of the British Commercial Gas Association, and Chairman of the Midland Gas Education Committee. He is also a member of the Council of the Midland District Board of the National Gas Council, the Federation of Gas Employers, and the Midland Regional Joint Industrial Council.

PRE-AMALGAMATION CONDITIONS.

The Borough of Dudley produced a large quantity of munitions of war during the period 1914 to 1918, and more particularly from the autumn of 1916. At that time a large national projectile factory and a privately owned factory, especially enlarged and reconstructed for the purpose of producing munitions, commenced operations. Large quantities of town gas were used, and difficulties resulted over which it is a pleasure to draw a veil of forgetfulness. The Town of Dudley Gas Light Company was so pressed for gas for war purposes that, together with one much larger Undertaking in a similar condition, it was prohibited during this period from supplying gas for motor vehicle use.

In consequence, the Dudley Company emerged from the war with extraordinary difficulties to face, including the reconstruction of its plant, and the replacement of its depleted financial reserves which had always been small.

The Company (one of the oldest in the country and incorporated by Act of Parliament passed in the "First and Second years of the Reign of His Majesty King George The Fourth") had been organized and managed prior to 1914 on very conservative lines, as had so many of the smaller provincial Companies. From 1919 onward, therefore, to the difficulties arising immediately from the war were added those of building up a staff and an organization on modern lines. The demand for gas followed what was probably a common experience in industrial towns—a large decrease in 1919, a period of oscillation to 1923, followed by a steady increase to 1932, when the effect of the industrial depression was felt. This effect was overcome in 1933, since when the output has continuously increased.

The war, with its upheaval of social customs and habits, left certain new features in our national life, one of which was a desire to enjoy more fully the country for the preservation of which such a heavy price had been paid.

Dudley is essentially a Black Country town, and has its fair proportions of soot and smoke; but it is on the western border of the Black Country and a journey of a few miles westward brings one to sylvan surroundings unsurpassed anywhere in England. The advent of the cheap motor car brought this country to the doorstep of the factory. Land was very difficult to acquire in Dudley, and desirable housing sites scarce. The inevitable took place. Those with a love of country surroundings built houses in the country, west of Dudley and outside the Dudley Gas Company's area, from and to which they travelled daily, usually by road.

This movement carried the possibility of two results detrimental to the Dudley Gas Undertaking.

First, the better class domestic consumer with his actual or potential demand for gas fires and water heating would be lost, and the Company's sales would become the supply of the small slot meter consumer, probably one of the most expensive, and of the industrial consumer, for whom a low price of gas is essential.

Second, many of these migrants were going to an area where the gas supply was in the hands of a Company still suffering from conservative management, conservative alike in its views of the necessity of constancy of quality, constancy of pressure, and efficiency of service. There became obvious in Dudley a reaction against gas by reason of the domestic experiences of business men living outside.

The possibility of amalgamation upon the western boundary was, therefore, seriously considered, and the proposal appeared to be a comparatively simple one to carry through. The company concerned was the Brierley Hill District Gaslight Company. It had an area 4½ times that of the Dudley Company but an output of about half. It covered the urban areas of Brierley Hill and Quarry Bank with a population of some 40,000 (Dudley's population was approximately 60,000), but the remainder of its area was very desirable country, ripe for good residential development. The areas of the two Companies were contiguous. There were one or two common directors and the stock and share structures were very similar.

CONSIDERATION OF AMALGAMATION.

Grouping by Holding Companies has taken its place in our Industry and in some cases has very definite advantages including the substantial one of avoiding the delay, expense, and dislocation of obtaining additional Parliamentary powers.

When an Undertaking is already well managed and has secured in a large measure the goodwill of its consumers, the retention intact of its local identity is an undoubted advantage. To this, holding company grouping under wise direction can add increased economy of operation and wider spheres of service. But in other cases an obvious change of ownership and direction may be advantageous, and this appeared to be the position.

Negotiations were commenced by the Dudley Company for the absorption of the Brierley Hill Company, and an agreement for that purpose was finally signed on the 6th February, 1929. Although the advantage of the proposed amalgamation to both parties appeared to be self-evident, negotiations were not entirely easy.

Physical amalgamation of the smaller provincial Undertakings is not easy even when such Undertakings adjoin and when the amalgamation is desirable in the interests alike of the proprietors, consumers and employees and of the Industry as a whole. The difficulty is the innate strength of the Gas Industry itself. Competition from many sources has been increasing during the last generation and becomes more severe every year. Yet there are very many Undertakings, whose products and whose ser-

vice are of a very low order when judged by the standard set by the premier Gas Undertakings, but which still manage to pay consistently their standard or maximum dividends or earn their interest and sinking fund charges and at the same time maintain or slightly increase their output of gas.

It is very difficult indeed for directors or committee men in such cases to realize that, in the interests alike of their consumers and their proprietors, improvement should be made in the operations of their Undertaking. Some improvement might, of course, be made without amalgamation or joint working, but very much wider scope is possible when working in bigger units.

It was a wise and desirable step when the Industry brought directors and committee men into close touch with each other in national organizations, in the British Commercial Gas Association, the National Gas Council and the Federation of Gas Employers. The more these gentlemen can be persuaded to attend the meetings and conferences of our national bodies, the more must they realize the implications of the public service which the Gas Industry sets out to perform.

A board of directors may give its Engineer and Manager full liberty of action, and very wisely usually does, but the Manager is very considerably helped in the heavy responsibilities he carries to-day by suggestions from well informed Directors upon practical lines of local policy. It is necessary for Directors and Committee men, in touch with the whole work of an Undertaking, to give the weight of their influence locally in the interests of the Undertaking as well as being responsible for the soundness of its finance. A weakness of holding company grouping may well be the lessening of this type of local influence.

Another difficulty in the way of amalgamation or joint working is, of course, the personal one—the doubt in the minds of directors and chief officers as to their positions after the re-organization.

Directors of considerable business ability and standing may perhaps be regarded as trustees for the stockholders and shareholders, and the fees paid to them in many cases can only be regarded as an acknowledgment of, and in no sense commensurate with, their services. With amalgamation and actual fusion their interest is usually continued on the new Board. But in holding company grouping, if the great majority of the shareholders sell their interests for cash or for shares in the holding company, the directors' trusteeship in connection with the local Company ceases, and questions of compensation should not be difficult to settle, nor should the amount of compensation, if any, be considerable.

In the case of chief officers the matter becomes a more important one. An Engineer and Manager may have achieved a position of responsibility and profit by many years of hard work and faithful service. The reward he has secured cannot be lightly regarded, and a re-organization in the name of the progress of the Industry cannot be allowed to inflict hardship upon an experienced and valuable member of the Industry, at a time, maybe, when his age makes the hardship irretrievable. Only when his position is assured can he be expected to be enthusiastic in his furtherances of the project contemplated.

On the other hand, if continued useful and lucrative service within his ability and an established future at least equal to his present position is assured to him, it is not reasonable for an officer to hold the scheme to ransom for his personal benefit and to secure " unearned increment " not based on capacity or service.

Another stumbling block in the way of amalgamation or grouping is occasionally the low capital expenditure per million cubic feet of gas sold of one of the Undertakings. The point is too considerable to discuss here in all its bearings. But it seems desirable to state that, however convenient, desirable and financially sound a low capital account may be, it is not necessarily a sign that the needs of the area for gas are being met better than, or as well as, those of an area in which the Undertaking has a heavier capital expenditure. The value of stock and shares depends on their dividend earning power and what they will fetch in the open market, and for shareholders in a Company with low capital to demand considerably more than this value is a definite block to progress. In a sentence, over-capitalization is unhealthy and indefensible.

PRICE AND DIVIDENDS.

In the case of the amalgamation of the Dudley and Brierley Hill Companies, the financial arrangement was comparatively simple. Both were maximum dividend Companies, and had paid their maximum dividends for many years. Both had original stock or shares carrying 10 per cent. maximum dividend, and other stock or shares carrying 7 per cent. maximum dividend. One had preference stock carrying 4 per cent. dividend, and the other had preference shares carrying 4½ and 5 per cent. Shareholders in both Companies were given stock in the newly formed Dudley, Brierley Hill and District Gas Company giving them an equivalent cash dividend to their holding in the original Companies.

For the purpose of simplicity, all preference stock in the new Company was made 5 per cent.; and all ordinary stock and shares were consolidated into 5 per cent. ordinary stock.

In the Board of Trade Order authorizing the amalgamation, the dividend arrangements were changed from the maximum dividend system to the basic price and dividend system, and stock was allotted on the basis of the 5 per cent. basic dividend.

The directorate of both Companies was combined to form the Board of the new Company. The total sum voted by the shareholders of the new Company for directors' remuneration was, upon the recommendation of the directors themselves, 16 per cent. less than the total of the remuneration of the two previous Boards. The Engineer of the Brierley Hill Company, of normal retiring age, was pensioned, while negotiations were in progress, by the Brierley Hill Company with the agreement of the Directors of the Dudley Company, and the Secretary of the Brierley Hill Company elected to retire upon pension after the amalgamation. Both pensions were approximately upon the Treasury scale.

Application to the Board of Trade for the Order was officially made in April, 1930; the Order was finally granted on the 29th July, 1931, the cost being approximately £3,000. While the delay and the cost were accentuated by certain facts, yet they are a standing example of some of the difficulties that stand in the way of such an amalgamation.

The chief fact increasing the delay and cost was the application for a basic price and dividend by Board of Trade Order, this being the first application for such an arrangement by Order. Considerable investigation and negotiation resulted, which were complicated by there being three different areas with differential prices. There emerged a Clause known as the Dudley Clause, of which the author hastens to disclaim paternity. The Clause had to be accepted in view of the costly alternative of abandoning the Order and applying for an Act of Parliament. Subsequent action by other Undertakings and Parliament in this matter are common knowledge and need not be related here.

RE-ORGANIZATION AT BRIERLEY HILL.

The work of re-organization of the new area and of the Brierley Hill Works was proceeded with to some extent while negotiations for the granting of the Board of Trade Order were proceeding, and upon the granting of the Order this work was accelerated.

The Brierley Hill Works had been equipped with horizontal retorts, a Fiddes-Aldridge stoking machine, and one small carburetted water gas plant which was used for peak loads only. Naphthalene was a prevalent difficulty on the district.

The declared calorific value of the gas was 450 B.Th.U. per cubic foot. As this was the same calorific value as in the Dudley area no alteration was made, but steps were immediately taken on the Works to supply a gas of more constant calorific value, and more desirable composition. Pressures on the district were surveyed and such steps as were possible were taken to improve these and to overcome the difficulties arising from naphthalene deposits. The difficulty of the increasing consumption from small wrought iron underground pipes soon became manifest, and it will need a considerable expenditure over several years fully to rectify this. The lower specific gravity of the gas now being supplied, however, has been of appreciable assistance.

Consideration was given to the staffing, both on the works and the district, and the methods in use in Dudley were introduced into the Brierley Hill area; the staff was augmented by drafts from the Dudley area. The two chief officers of the Brierley Hill Company elected to retire with compensation, but it is a pleasure to be able to say that the whole of the remainder of the staff and men were absorbed, none being displaced by reason of the amalgamation. Some, of course, had to do different work, but the total number of men employed by the amalgamated Company to-day exceeds the total of the two Companies before amalgamation.

Evidence of the satisfaction of the consumers with the changes quickly accumulated, and the result has been a more rapid increase in the output of gas in the Brierley

Hill area than in the Dudley area. In fact, while in 1932 the Dudley area suffered from the industrial depression, the Brierley Hill area experienced an increased demand.

CONSIDERATION OF THE RECONSTRUCTION OF THE GAS MAKING PLANT.

After the immediate work of reorganizing the Brierley Hill management and carrying out such urgent reconstruction as was immediately possible upon the works and district, it became clear that the cost of manufacture at Brierley Hill was approximately one penny per therm put into the gasholders more than at Dudley. The increasing consumption of gas in Dudley at this time made the consideration of extensions an urgent matter, and the whole question of extensions and future policy was therefore considered at some length. There were the following possibilities:—

(1) The extension of the vertical retort plant at Dudley to meet Dudley's needs only.

(2) The replacement of the manufacturing plant at Brierley Hill, to produce a reduction in cost, with possibly a connecting main to the Dudley Works to allow an interchange of gas.

(3) A large extension of the plant at Dudley, to enable the whole area to be supplied from Dudley and the Brierley Hill works to be shut down as a manufacturing station.

(4) A large installation of plant at Brierley Hill to manufacture gas for the whole area at an economical price and the shutting down of the Dudley Works as a manufacturing station.

(5) The erection of plant upon a new site to form the nucleus of one large Works eventually to supply the whole area, the new Station being (*a*) of sufficient size immediately to allow the Brierley Hill works to be shut down as a manufacturing centre, or (*b*) of sufficient size to allow both Works to be shut down.

In reviewing these questions the following considerations were borne in mind:—

(*a*) The Dudley works was badly situated away from any possible railway connection and from the canal, and suffered from consequent heavy transport charges on coal. It was in one of the most elevated parts of the whole area, increasing distribution difficulties; and it was very restricted in its ground space, making considerable extensions difficult. On the other hand it was surrounded by a dense urban population and large industrial consumers together taking two-thirds of the Company's output of gas and absorbing the greater part of the coke output. It was already equipped with modern vertical retort plant with some facilities for extension.

(*b*) The Brierley Hill Works was from some points of view better situated, being in one of the lower levels of the district, and it had considerable land unused. It was surrounded by the urban part of its area of supply, but its plant was not of the most economical design or in good condition; it was not economically advisable to extend the existing plant. The Works had canal facilities, but these did not to any extent lower the cost of transport of its coal, which had to travel by rail and be unloaded at the local station into canal barge for transhipment to the Works canal wharf.

(*c*) Within the area of supply, almost geographically central but further away from the situation of the Company's major consumption than the existing Dudley Works, there existed a favourable site for a new Works which could be purchased at a low cost, the site possessing both rail and canal facilities.

(*d*) The capital of the Company, and the absence of any Special Purposes or Renewal Funds. The predecessors of the directors and of the author had never formed Special Purposes or Renewal Funds, and their formation in the difficult post war years was not found possible. The capital of the two Companies for several years and of the amalgamated Company is given in Table 1.

TABLE 1.—*Capital Employed and Dividend and Interest Charges; Dudley and Brierley Hill.*

Year.	Capital, including Bank Overdraft (if any) at end of each year, in £ per Million Cubic Feet of Gas Sold. Dudley. A.	Dudley. B.	Brierley Hill. A.	Brierley Hill. B.	Gross Dividend and Interest Charges, including Bank Interest. Per 1,000 Cu.Ft. Gas Sold. Dudley.	Per 1,000 Cu.Ft. Gas Sold. Brierley Hill.	Per Therm Gas Sold. Dudley.	Per Therm Gas Sold. Brierley Hill.
1	2	3	4	5	6	7	8	9
	£	£	£	£	Pence.	Pence.	Pence.	Pence.
1913	509·5	513·2	575·5	553·9	9·15	10·16	..	..
1919	539·7	455·3	575·0	511·5	8·94	9·09	..	..
1929	496·6	408·8	729·0	689·4	8·14	10·75	1·81	2·39
1930	507·2	400·8	786·0	716·3	8·22	11·68	1·83	2·60

Year.	Dudley and Brierley Hill. A.	B.	Per 1,000 Cu.Ft. Gas Sold.	Per Therm Gas Sold.
10	11	12	13	14
	£	£	Pence	Pence
1931	792·5	592·4	9·33	2·07
1932	909·5	670·8	9·99	2·22
1933	897·5	666·6	9·97	2·22
1934	865·5	672·6	9·98	2·22
1935	840·4	665·9	9·58	2·13

A. = Issued share and loan capital (excluding premiums) including Bank overdraft, all other loans if any, and nominal capital added upon consolidation of stock in 1931.

B. = Capital expenditure (excluding nominal amount added on conversion).

Table 2 gives the sales of gas for the corresponding years and Table 3 the net average income from gas sales.

TABLE 2.—*Sales of Gas; Dudley and Brierley Hill.*

Year.	Dudley. Thousands of Cu.Ft.	Dudley. Therms.	Brierley Hill. Thousands of Cu.Ft.	Brierley Hill. Therms.
1	2	3	4	5
1913	190,580	..	91,305	..
1919	223,165	..	110,724	..
1929	306,334	1,378,497	127,217	572,476
1930	316,299	1,423,301	130,191	585,861

Year.	Dudley and Brierley Hill. Thousands of Cu Ft.	Therms.
6	7	8
1931	444,779	2,001,504
1932	430,382	1,936,718
1933	457,805	2,060,125
1934	467,906	2,105,577
1935	495,241	2,433,024

In Table 1 is shown the Gross Dividend and Interest Charges per 1,000 cu.ft. and per therm. These figures are of considerably more value and interest than the capital expenditure figures. It will be seen that at Dudley these charges per 1,000 cu.ft. of gas were being consistently reduced after the termination of the Great War, although reconstruction in all directions was taking place.

In 1930, however, a fresh factor came into operation. House building operations which had been carried on by the Local Authorities became very much intensified, and in consequence the rate of capital expenditure began to exceed considerably the rate of increase of gas sales. Whereas the actual total capital expenditure of the amalgamated Company was under £600 per million cubic feet of gas sold, the expenditure upon schemes for distribution plant, after allowing for such contributions as could be obtained from the Local Authorities, began to amount to over £1,500 per million cubic feet of gas sold. During four years on one estate alone the cost has been some £30,000. Taking into account every possible private enterprise house and street lighting scheme, to the consumption of which this expenditure could be held to contribute eventually, the expenditure still remains at over £1,000 per million cubic feet of gas consumption obtained.

While engineering problems are still of first rate im-

portance, and whilst the problems of salesmanship including the promotional tariff question occupy quite legitimately so much of our attention, financial questions must remain predominant. At the back of every decision must be a satisfactory answer to the questions "What will it cost?" and "Will it pay in the long run?" The author

TABLE 3.—*Average Income from Sales of Gas (including Public Lighting and under Contracts, but excluding Public Lighting Revenue Expenditure) per 1,000 Cu Ft. and per Therm sold; Dudley and Brierley Hill.*

Year.	Dudley. Average Income per 1,000 Cu.Ft. Sold.	Dudley. Average Income per Therm Sold.	Brierley Hill. Average Income per 1,000 Cu.Ft. Sold.	Brierley Hill. Average Income per Therm Sold.
1	2	3	4	5
	s. d.	Pence.	s. d.	Pence.
1913 . .	2 6·89	..	3 2·86	..
1919 . .	4 1·55	..	4 1·83	..
1929 . .	3 4·56	9·10	4 0·75	10·83
1930 . .	3 3·61	8·80	4 0·64	10·81

Year.	Dudley and Brierley Hill. Average Income per 1,000 Cu. ft. Sold.	Dudley and Brierley Hill. Average Income per Therm Sold.
6	7	8
	s. d.	Pence.
1931 . .	3 6·66	9·48
1932 . .	3 7 07	9·57
1933 . .	3 6·21	9·38
1934 . .	3 5·62	9·25
1935 . .	3 5 68	9·26

is of opinion that such district development expenditure will pay in the long run, but it will be a Marathon race and not a sprint, and questions of expediency of policy have to be given considerable credit. Within the length of time for which any judgment can be made such expenditure will permanently increase the capital per million cubic feet. This must be realized and faced. It intensifies the necessity for the Gas Industry to be given statutory powers, particularly as to the charging for gas, at least as wide as its chief competitor. It emphasizes the necessity of pressing local authorities for impartial consideration of the final effect of their actions when they are deciding what public services are to be introduced into council houses of low rentals. Gas is the only public service which can offer a source of heat and light for all purposes in a council house at a price which the tenant can afford; and gas does it with greater efficiency, practical and national, than electricity. To install both in such houses, each to do only part of the work, is uneconomic and increases the cost of both services, in addition to increasing the capital cost of the houses.

It certainly is no argument for members of Town Councils, who live in houses costing £1,000 and more to build, to say that because they choose electric light the artisans must also be given it. One might equally well say that because the occupant of the £1,000 house goes to his business in a car, council houses must of necessity be provided with garages. The £1,000 house can afford uses of electricity that can make that service remunerative, while at the same time it nearly always consumes large amounts of gas making that service also remunerative.

Preliminary consideration of the schemes already set out made it clear that the only practical ones were numbers 3, 5*a*, or 5*b*, for which approximate figures are given in Table 4.

The costs given for schemes 3 and 5*a* include the transfer of suitable plant from Brierley Hill to deal with the increased make on another works and therefore Brierley Hill would not be available for gas making subsequently. Similarly 5*b* includes the removal of suitable plant from Dudley and Brierley Hill, both of which would be subsequently shut down.

Interest, in column 4 of Table 4, is given upon the whole cost as money had to be borrowed to carry out the work: but obviously some part of the cost was a proper revenue charge in so far as existing works were scrapped. There had to be a credit balance between the interest charge and the saving to be effected, column 5, to allow the revenue charge to be met eventually.

Consideration was given to the possibility of government grants towards the work as an aid in the reduction of unemployment, but this consideration did not materially affect the final position nor the decision.

Schemes 5*a* and 5*b* had a very obvious appeal and offered sound engineering progress. Both entailed a step which it is felt will have to be made sometime, but for financial reasons it was finally decided to adopt Scheme 3—to extend the existing vertical retort installation at Dudley by two settings similar to those already in use there, *i.e.*, of eight 40 in. size, to add such additional ancillary plant as this would necessitate, and to shut down Brierley Hill Works as a gas making station.[1]

TABLE 4.—*Comparison of Three Possible Schemes of Reorganization.*

Scheme.	Description.	Approximate Cost.	Interest at 6 Per Cent. per Annum of the Total.	Probable Saving per Annum.
1	2	3	4	5
		£	£	£
3	The extension of the vertical retort plant at Dudley by a unit with maximum capacity of 1½ mill. cu.ft per day with compressors at Dudley and a connecting main to Brierley Hill, together with the necessary additions to ancillary plant at Dudley. . .	36,000	2,160	3,000
5*a*	Erection of units of vertical retorts with capacity of 1½ mill. cu.ft. per day on a new site, together with the necessary mains, plant, buildings, and small gasholder which a new site would necessitate, with compressors and connecting main to the Dudley and Brierley Hill Works.	67,000	4 020	3,000
5*b*	Erection of units of vertical retorts with a capacity of 2½ mill. cu.ft. per day, together with all the necessary mains, purifying plant, buildings, and a small gasholder, with compressors and connecting main to the Dudley and Brierley Hill Works . . .	106,000	6,360	4,500*

* Problematical and approximate.

RECONSTRUCTION.

Further consideration was then given to the scheme adopted, with a view to making certain improvements in the plant and layout generally at Dudley; as a result the final estimate for the work was some £38,740 and the final actual cost £39,587. Of this amount it was estimated that £18,894 was a capital charge due to increased total gas-making capacity, and that £20,693 was a revenue charge, being the cost of that part of the extensions which replaced the scrapped Brierley Hill plant and the small amount of Dudley plant replaced.

Upon this matter the peculiarities of the operations of the income tax laws and regulations, so often discouraging to the trade and business progress of the country became exemplified. If the plant to be scrapped had been on Dudley Works there is no question that practically the full cost of the replacement, £20,693, would have been allowed for income tax computation as a revenue expenditure. It would have been allowed if the new plant had been erected at Brierley Hill, where the plant was to be scrapped—and the cost thus allowed would have been much heavier. But in the existing conditions the only allowance that could be obtained was the estimated value as a going concern of the plant to be scrapped depreciated according to its years of use and probable future life, although in fact no past depreciation had ever been claimed or allowed. In the final settlement £14,850 was allowed to rank for income tax relief.

It was finally decided to install twelve ordinary continuous 40 in. vertical retorts similar to the existing type, together with two 90 in. semi-intermittent retorts, in the same steel framework as the continuous retorts. This decision was made in order to obtain a small proportion of coke harder than the ordinary continuous coke for certain consumers who had previously been using the Brierley Hill horizontal coke and had expressed a preference for that type.

The installation of continuous vertical retorts was of the well known standard Glover-West type. The less familiar semi-intermittent retorts were dealt with fully by Mr. E. L. Wallis, the Company's Chief Chemist at that time, in a Paper read before the Midland Junior Gas Association on

[1] Owing to the rapid increases in consumption of gas, particularly for industrial purposes, two further settings each of eight 50 in. continuous retorts are now (March 1, 1936) being erected.

1st February, 1934. The whole installation was fitted with a Spencer-Bonecourt waste heat boiler.

Coke Screening Plant.

Dissatisfaction had been felt for some time with the method of dealing with coke. The coke from the vertical retorts was handled by the lip-bucket conveyor, dropped down a long chute into a brick built hopper external to the retort house, whence it ran over static bar screens into vehicles for sale. The lip-bucket conveyor was of 35 tons of coal per hour capacity. Excessive loading of coke in the buckets was prevented by a smoothing plough, which resulted in considerable grinding and breakage. The long drop down the chute and into the hoppers increased this breakage, and in consequence most of the coke sold was very small. Small coke may be as good fuel as large, but certain consumers complained constantly, mainly due to the spaces between the fire bars of their consuming appliance. Static screens are definitely unsatisfactory and coke went out with excessive dust. All these disadvantages appeared to become accentuated with the increased output arising from the extensions. Spot tests gave the results reproduced in Table 5.

TABLE 5.—*Spot Tests on Ungraded Coke with Old Coke Handling Plant; Dudley Works.*

Test.	Size.	Coke Straight from Retorts.	Coke in Coke Hopper after Handling by Conveyor.	Coke in Lorry Going out to Consumer.
1	2	3	4	5
		Per Cent.	Per Cent.	Per Cent.
1.	Over 2 in. screen	20·0	7·2	9·7
2.	Over 1½ in. through 2 in. screen	25·0	26·0	35·1
3.	,, 1 in. ,, 1½ in. ,,	24·0	26·8	36·2
4.	,, ½ in. ,, 1 in. ,,	16·0	18·9	14·0
5.	,, ¼ in. ,, ½ in. ,,	7·0	11·5	2·7
6.	Through ¼ in. screen	8·0	9·6	2·3

It was decided to replace the existing conveyor with another lip-bucket conveyor of double capacity. It was felt that the larger buckets would cause less breakage, particularly if the smoothing plough could be abandoned; the difficulties foreseen with the skip hoist mentioned above would be avoided and the cost of the overhaul of the old lip-bucket conveyor would be saved. The newer type offered automatic grease gun lubrication, which it was felt would reduce considerably the wear on bearings, due to coke abrasion, to little more than the normal wear with coal. This scheme was more expensive, but it was finally decided to adopt it. In place of the smoothing plough there was devised by the Company and adopted a simple mechanical feeding arrangement at the outlet of the travelling coke chute that conducts the coke from the retorts to the conveyor. This is operated by the conveyor itself, is quite simple, avoids all cutting and crushing of the coke, and has been successful. The author, however, refrains from giving a diagram as he does not consider the design final, the mechanism not yet being quite fool-proof.

It was decided to install the West system of grading plant in which the motion is comparatively slow and, due to its rubber suspension, quiet.

Three sizes of coke have been adopted and up to the present this has been found not unsatisfactory. It was felt that four sizes might have suited Black Country conditions better; but it was desired to keep the harder coke from the semi-intermittent retorts separate in the larger sizes, and the necessity of so many divisions for four sizes in each then became a difficulty, and added an increased capital cost which it was felt was not justified.

The hoppers have been fitted with outlets on one side for bagging and on the other side for road vehicles, and both sides have been fitted with vibrating wire debreezing screens, one on the former and two on the latter side. These screens travel by hand power along rails to the needed positions.

There is no electricity used on Dudley Gas Works. It is not available from the town supply and at each extension and consideration of the subject it has been cheaper to adopt steam from waste heat boilers. The whole of the new coke plant is driven by small high speed steam engines. The debreezing screens are all operated by a simple friction drive from one line shaft running under the hoppers. After the preliminary difficulties which arise with most new installations, the new coke plant has been quite successful. The cost of the whole installation was some £5,221. No difficulty has been experienced in obtaining from 1s. 6d. to 3s. 0d. per ton extra on all coke sold, including contracts when these became due for renewal, though it must be confessed that this was assisted by a shrinkage of coke stocks generally in the district at the time these increased prices were asked. On the other hand no other gas undertaking in the neighbourhood increased coke prices.

As a comparison with the figures given in Table 5, the following are the proportions of graded coke sold since the plant has been in operation.

Over 2 in.	34·5 per cent.
Under 2 in. and over ¾ in. . . .	52·1 ,,
Under ¾ in. and over ¼ in. . . .	3·3 ,,
Under ¼ in. including dust . . .	10·1 ,,
	100·0 ,,

When the Brierley Hill Works was shut down as far as gasmaking was concerned, it was retained as a distribution and service depôt for the Brierley Hill area. The plant not being utilized at Dudley was scrapped and dismantled. Alterations had previously been made to simplify certain gasholder and booster connections; this work was continued and the valves concerned concentrated in the booster house. A Connersville meter was installed to measure the gas being received under high pressure from Dudley, and a smaller Connersville meter to measure the gas passing Brierley Hill and going on to Kingswinford 4 miles away and to Kinver 8¾ miles away. At these places there exist two more small distribution and service depots serving semi-rural areas.

RESULTS OF THE AMALGAMATION.

While much still remains to be done—notably in connection with stores arrangements, the cooker repairing shop and an industrial demonstration department—the results of the amalgamation already achieved are considered to be entirely satisfactory both to Dudley and to Brierley Hill, and to the Gas Industry generally in the vicinity.

The net cost of gas into holders at Brierley Hill in 1928, the last year unaffected by any amalgamation negotiations, was 5·72d. per therm of gas sold (the average of the four years 1924, 1925, 1927 and 1928 was 5·81d.). The cost at Dudley was 4·59d.[2] per therm of gas sold in 1929, the last year unaffected by amalgamation negotiations (the average of the four years 1925, 1927, 1928 and 1929 inclusive was 5·10d.). The average net cost of gas into holders for the years 1933 and 1934 during which all gas was made at Dudley was 3·68d. per therm sold.

There has therefore been effected a saving of 35·7 per cent. in the cost of making gas for Brierley Hill and of 19·8 per cent. in the cost of making gas for Dudley.

The price per ton of coal being purchased at Dudley in 1934 (not necessarily the same coal) was 7·9 per cent. less than in 1929 and the yard price of coke was 13·6 per cent. more. These alterations would account for a reduction of 0·42d. per therm in the cost of gas made at Dudley. This leaves a net percentage reduction in cost of gas into holders which can be attributed to the amalgamation of 10·7 per cent. at Dudley and (assuming the same coal and coke price movements could have been reproduced without amalgamation at Brierley Hill as took place during the period at Dudley) of 28·4 per cent. at Brierley Hill. The total net saving on this item alone is approximately £7,500 per annum.

The aggregate sales of gas over the period increased by 8·1 per cent. which, of course, accounts for part of this decreased cost. It is estimated, however, that the greater part of the saving is in the cost of manufacturing the gas for Brierley Hill and therefore properly considered a result of the amalgamation.

The allocation of the saving requires consideration. In the author's opinion, the cost of the extensions at Dudley to replace the Brierley Hill plant must be met first. After that the saving on the manufacture of the gas consumed in Brierley Hill less the cost of transporting it there may legitimately be claimed for the Brierley Hill consumer and the saving on the Dudley gas for the Dudley consumer. The Brierley Hill consumer has already been given a substantial advantage by the introduction of a block scale of charge. Any additional saving passed on to him would be by an improvement in the block scale (and the two-part tariff when introduced)[3] and not by an all round reduction.

The gas in Brierley Hill has been considerably improved in composition, specific gravity, and naphthalene content as is inevitable with the replacement of low grade gas made in horizontal retorts by gas made in vertical retorts. This has resulted in a reduction of distribution difficulties

[2] This figure includes the usual net coal, purification wages, repairs, and salary costs. The salary item includes a proportion of the salaries of the Engineer and Manager, the Deputy-Engineer, and the clerical staff, as well as direct works supervision salaries.

[3] The Two-Part Tariff has since been introduced into all parts of the Company's area of supply (1st March, 1936).

and an increase in the consumers' satisfaction. This result could have been brought about, of course, by the replacement of the plant without amalgamation, but it needs no figures to substantiate the statement that extension of the existing Dudley vertical retort plant was cheaper than the installation of a new plant at Brierley Hill.

There has been a definite saving in purchasing and substantial reductions have been obtained on prices for the same goods previously paid at Brierley Hill. How much of this is due to larger scale buying, and how much to a different point of view in the buyer, it is impossible to compute.

No opinion upon the effect of amalgamation can be drawn from figures of the average consumption per consumer. Any conclusion is vitiated by two facts; first the much larger percentage of gas sold for industrial purposes in the Dudley area than in the Brierley Hill area, and its rapid variations with the state of trade; and, second, the different and varying policies of the various local authorities in the two areas in connection with the method of lighting the houses which they continue to build. It is, however, interesting to note in passing that the average consumption of the ordinary meter consumer has increased in both areas from 1929 to 1934, while that of the prepayment meter consumer has decreased in both areas; the decrease has been very much less in Brierley Hill than in Dudley. The total number of consumers during the period has increased by 24 per cent.

Both Dudley and Brierley Hill are coal mining areas and have distribution difficulties due to subsidence. The unaccounted-for gas in Brierley Hill before the amalgamation averaged over 21 per cent. of the gas made. By 1934 this had been reduced to 13·3 per cent. and is being still further reduced. During the same period the unaccounted-for gas at Dudley was lowered from 6·3 to 5·0 per cent.

Other advantages of physical amalgamation such as the adoption of a common sales policy over a wider area, the possibility of employment of specialists on the staff, the smaller stocks of appliances required to give the same rapid service are too obvious to need elaboration. But they certainly prove in practice to be true.

There is a limit, in the author's view, to the size of an undertaking which can usefully be formed in the provinces by physical amalgamation. Personal contact is, of course, of the greatest importance in any business; but in the provincial gas undertaking it is necessary for the humblest consumer, if he feels he has a legitimate grievance which he cannot get settled to his satisfaction, to be able eventually to get into personal contact with the chief executive officer who can settle the matter on the spot without having to refer it to a superior or to a Board or Committee, and who has the power to break cast iron rules for expediency's sake. Any amalgamation so large that this is impossible is too large.

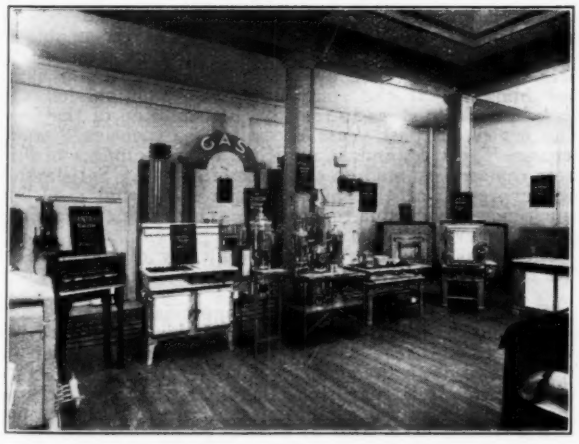
In the author's view, an undertaking situated in a populous area with an annual make of 500 mill. cu.ft. has not reached the limit, nor, in fact, has it reached the point where full advantage can be taken of large scale operations on the district.

In the provinces there are districts with numbers of Urban Authorities and Boroughs quite close together. The stranger would find it difficult to notice the boundaries; but there is nearly always an intense local patriotism and occasionally, unfortunately, acute local antagonism. This is unquestionably a hindrance to efficient local government, and must be taken into account when gas undertaking amalgamation is under consideration. It might be a serious tactical error to introduce the name of Borough A into the name of the undertaking of an adjoining but antagonistic urban area B, or even to drop the local name of area B from the name of its undertaking. Such cases may be better arranged—even if only temporarily and in some senses not so conveniently or satisfactorily—by holding company arrangements.

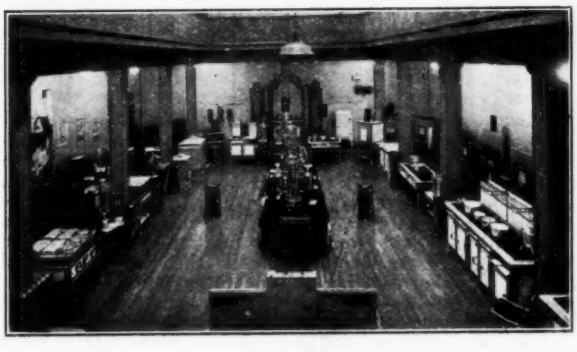
In conclusion, the author thanks his Directors for permission to give this Paper, his staff for their loyal and consistent service during the carrying out of the amalgamation, those who assisted in the preparation of this Paper for their assistance, and particularly his Deputy, Mr. L. P. Ingram, M.Sc., M.Inst.Gas E., A.I.C., upon whom fell the responsibility for most of the detailed work arising during the amalgamation.

Hotel and Catering Equipment Exhibition at Newcastle

Many useful enquiries resulted from this Exhibition of catering and other equipment for hotels, restaurants, cafés, &c., which was held from May 5 to 9 in the "Chronicle" Hall by the Newcastle-upon-Tyne and Gateshead Gas Company.



Invitation cards to the number of 1,100 were sent out to interested parties throughout the Company's own area and that of the North-Eastern Industrial Gas Development centre. The following were among the firms whose equipment was included in the Exhibition: John Wright & Co., Ltd., Fletcher, Russell, & Co., Ltd., E. W. Proctor, W. Eardley & Co., Ltd., Jackson Boilers, Ltd., Euk Manufacturing Co., Ltd., Thomas Potterton, Ltd., Parnall & Sons, Ltd., and Eclipse Copper Co.



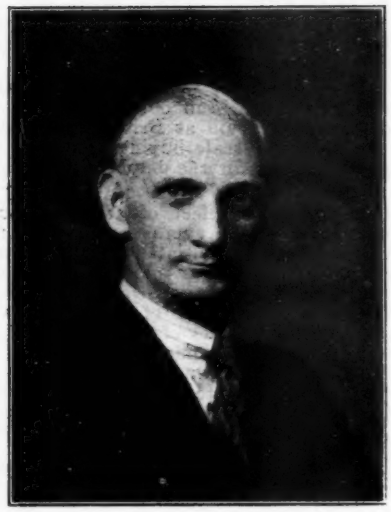
(Communication No. 132)

The Two-Part Tariff as an Aid to Gas Sales

by

JOHN T. HAYNES

(Formerly Engineer and General Manager of the Rotherham Gas Department)



JOHN T. HAYNES, Assoc.M.Inst.C.E.

Born at Liverpool in 1892, Mr. John T. Haynes was educated at Liverpool College, and later continued a long family association with the Liverpool Gas Company when he became an articled pupil, and afterwards Engineering Assistant to the late Edward Allen, M.Inst.C.E. During the war he served with the Royal Engineers in Salonica as a Commissioned Officer. Then for two years he was Assistant Engineer at the Lancaster Gas-Works under Mr. George Dixon, B.Eng., A.M.I.C.E., now of Nottingham. In 1921, Mr. Haynes was appointed Works Manager, and later Assistant Engineer, to the Bolton Gas Department under Mr. W. J. Smith, B.Sc. Here he carried out considerable reconstruction and increased the capacity of the Bolton Works plant from 2 million cu.ft. to 6 million cu.ft. per day. In 1931, he was appointed Engineer and General Manager to the Rotherham Gas Department. Here he gained considerable experience in the collection, transmission, and utilization of coke oven gas for domestic and industrial uses. In addition, he designed and operated a two-part tariff for both ordinary and prepayment domestic consumers. In 1936, he accepted the appointment of General Manager of the Victory Works, Manchester, of Messrs. Parkinson & Cowan (Gas Meters), Ltd.

The Rotherham Gas Undertaking was purchased by the Local Authority in 1871, and for many years followed the course of most municipal gas undertakings. It now serves a population of over 100,000, about half of whom are dependent on the coal industry, most of the remainder being dependent on the steel and allied industries. For many years part of the profits of the Undertaking have been used for the relief of local rates, the total sum so used now exceeding the outstanding capital of the Department.

In 1918, the Corporation obtained parliamentary powers to purchase crude gas from local coke ovens, but the powers were not used to any great extent until 1928, when it was decided to cease the manufacture of Gas, except in emergency, and to rely entirely on supplies of Coke-Oven Gas.

Some years previously, attempts had been made to persuade local industrial works to use Gas as a fuel, but these failed almost completely because the price was too high compared with that of local coal. In recent years, however, coke oven gas, both crude and purified, has been offered by the Rotherham Corporation Gas Department, subject to certain conditions, at prices which are competitive with coal, and in seven years the sales of Gas have been trebled—a development without parallel in this country.

Table 1 shows that the sales per domestic consumer at Rotherham have fallen steadily year by year, in common with those of other Gas Undertakings.

TABLE 1.—*Sales of Gas to Domestic Consumers: Rotherham Corporation Gas Department.*

Year.	Gas Sold for Domestic Purposes.	Number of Domestic Consumers.	Average Sales per Domestic Consumer.	Total Sales of Gas, for all Purposes per Head of Population.
1	2	3	4	5
	Thous Cu.Ft.		Thous. Cu.Ft.	Thous. Cu Ft
1913–14 .	255 470	16.761	15·2	4·2
1923–24 .	258.459	17,190	15·0	3·8
1928–29 .	294.337	19,759	14·9	6·3
1933–34 .	339.473	23,626	14·4	12·9
1934–35 .	343 122	24,106	14·2	14·9

Following a full debate some years ago, the Rotherham Town Council decided that all houses erected by them should be lighted by electricity, and other builders have followed that example. There is no denying the popular appeal of electricity for lighting, and the facilities offered by the Electricity Department in the way of Multiple Tariffs, Assisted Wiring, All-in Rates, and special rates for certain purposes, have resulted in an accumulating loss to the Gas Department of some 10-12 million cu.ft. per annum—approximately 3 per cent. of the greatest profit making load.

As some compensation for the loss of lighting load, the Corporation in one of their earlier housing schemes installed gas fires in the sitting rooms and in the principal bedrooms. Unfortunately, a design of fire was adopted which is very inferior to present-day standards, and in many cases the chimney flues were unsatisfactory. Shortly after taking over the management of the Rotherham Undertaking in 1931, the author was confronted with a threat of complete prohibition from new housing estates, except for gas wash-boilers and gas rings. Complaints had been received that the occupants of many of the houses—mostly poor people unemployed for many years—were unable to afford the cost of Gas for heating, and that some of the fires when in use were unsatisfactory. The author satisfied himself that the complaints were well-founded and took immediate steps to remedy the condition of the fires. The neglect of past years necessitated expensive "maintenance" service, and, in addition, a large number of fires were replaced by modern ones free of charge. Satisfaction was expressed at the improvements made and a feeling much more favourable to Gas was aroused; a new standard of "Gas Service" was established.

There was, however, still the difficulty of the price of Gas being prohibitive for continuous use.

Members of the Institution will appreciate that the conditions outlined in the latter part of this section are not peculiar to Rotherham, but are typical of many undertakings up and down the country, particularly those in industrial areas. It is suggested, therefore, that the methods adopted to meet the conditions and the results obtained at Rotherham may serve as a guide to other undertakings with similar difficulties.

APPLICATION OF THE PRINCIPLES.

(1) Preliminary Enquiries and Classification of Consumers.

The complaint against the Gas Department was that the price of Gas was so high that the poorer householders, most of whom use slot meters, could not afford to use gas fires costing 1½d. to 2d. per hour—Gas being 3s. 4d. per 1,000 cu.ft. through slot meters.

The finances of the Department were such that a reduction of 2d. per 1,000 cu.ft. might have been made if the whole of the net profits were sacrificed, but such a reduction would have made very little difference in the hourly

TABLE 2.—*Classification of Consumer 1930; Rotherham Corporation Gas Department.*

Class of Consumer.	Under 5 Thous. Cu.Ft. p.a.	5 to 10 Thous Cu.Ft. p.a.	10 to 15 Thous. Cu.Ft. p.a.	15 to 20 Thous. Cu.Ft. p.a.	20 to 50 Thous. Cu.Ft. p.a.	Over 50 Thous. Cu.Ft. p.a.	Totals.
1	2	3	4	5	6	7	8
Corporation houses –							
Ordinary	3	7	12	10	7	1	40
Prepayment	503	1,057	483	173	89	..	2 305
Total	506	1,064	495	183	96	1	
Others up to 6 rooms –							
Ordinary	173	443	387	260	419	36	1 718
Prepayment	671	3 560	4 586	2 726	2,126	63	13 732
Total	844	4 003	4 973	2 986	2 545	99	
Over 6 rooms—							
Ordinary	34	81	97	67	190	81	550
Prepayment	14	52	72	49	89	14	290
Total	48	133	169	116	279	95	
Grand Total	1 398	5 200	5,637	3 285	2,920	195	

Domestic consumers	18,635
Commercial and industrial	1,977
Total	20 612

Average Consumption.

Corporation houses	8 900 cu ft
Ordinary meters	17 600 ,,
Prepayment meters	13,900 ,,
Average (domestic only)	14,600 ,,
All consumers (including industrial)	30 400 ,,

Calculated average economic domestic consumption = 15 500 cu.ft.

Number of uneconomic domestic consumers = 12,235 (= 66 per cent.).

cost of a gas fire, and the small consumer would benefit to the extent of less than ½d. per week; the large consumer alone would receive material advantage. The Gas Committee accepted this view of the matter.

There was a suggestion that Corporation tenants should be charged a weekly rental to provide for an unmeasured and unlimited supply of Gas. Estimates were made and it was considered that a rental of more than 5s. 0d. per week would be required if the Department was to be safeguarded against wasteful and excessive use of gas. This weekly cost was of course prohibitive, and so the suggestion was dropped.

It was then proposed that every consumer should be charged a greatly reduced price for all Gas used in excess of his normal consumption. This sounded attractive, but examination revealed a number of difficulties. What was a consumer's normal consumption? A large number of typical meter cards were examined, and adjacent houses were found to have widely different consumptions, affected by the number in the family, periods of sickness, inclination or disinclination to use Gas, &c. The application of the proposal in such cases would quickly create a sense of unequal treatment between neighbours, and could not be defended by the Undertaking in the light of the equal conditions clauses in the Corporation's Gas Acts.

The problem was then considered in the light of the author's experience with a variation of the Block System, designed by Mr. W. J. Smith, B.Sc., at Bolton. Varying in size with the number of rooms in the house, the first block was supplied at the standard price, and all Gas used in excess of the first block was charged at a reduced price. The quantity in the first block was greater in the winter half-year than in the summer.

Before applying this principle in Rotherham, it was necessary to know the consumptions of different types of houses. No records had been made previously, so there was a long process of tabulating all the meter cards and rental books to obtain the information summarized in Table 2.

Various calculations were made from the information obtained, and a scheme was submitted to the Borough Treasurer for his observations. He was in sympathy with the attempt to increase the sales of Gas, but criticized the suggested scheme as being troublesome to work. The continuous reading of meters would prevent equal demarcation between summer and winter for different consumers and might lead to disputes, more particularly with prepayment consumers. The scheme would give an immediate bonus to large consumers without being attractive to those whose consumptions were well below the limit of the first block. It was therefore decided not to proceed further with this scheme.

(2) Allocation of Expenditure.

When discussing the idea of an inclusive rental, referred to on page 13, it had been suggested that the wasteful use of Gas might be minimized if the rental were reduced and a nominal Commodity Charge made for all Gas used, so that waste would be penalized. This of course was an introduction to the consideration of a Two-Part Tariff, but it was only after other ideas had been thrashed out that a multiple tariff was seriously considered. Calculations were made both from the view point of a theoretical Service Charge to find the Commodity Charge which could be made, and from the view point of the lowest possible Commodity Charge to find the Service Charge necessary to cover it, and then working inwards to find a tariff scale which combined the theoretical with the practical, expediency being an ingredient.

First the theoretical Service Charge as suggested by the National Gas Council Report of the Committee on Gas Charges was considered.

The output of the Department was separated into three groups—Domestic, Industrial, and Crude Gas sold direct. The expenditure of the Department was then proportioned to the three groups as is shown in Table 3.

TABLE 3 —*Allocation of Expenditure; Rotherham Corporation Gas Department.*

BASED ON ANNUAL ACCOUNTS 1931-32.

Class of Expenditure.	Crude Gas, 211 Mill. Cu.Ft.	Purified Gas to Industry, 217 Mill. Cu.Ft.	Gas Sold for Domestic Purposes, 336 Mill. Cu.Ft.
1	2	3	4
	Per Cent.	Per Cent.	Per Cent.
Purchase of crude gas	Direct Pro	portion of T	otal cost
Other works costs	1	39	60
Meter repairs (slot)	..	..	100
Meter repairs (ordinary)	..	40	60
Balance of distribution costs	1	19	80
Rates	..	20	80
Management	2	13	85
Redemption of debt	..	20	80
Interest	1	19	80
Income tax	2	28	70
Net profit	1	9	90

The expenditure chargeable against the domestic gas sold for the financial year 1931-32, the year immediately preceding the calculations, was then allocated in accordance with the National Gas Council Report as is shown in Table 4.

Estimates, similar to that illustrated in Table 5, were made of the possible consumptions of gas in several average households by aggregating the gas used for cooking, water heating, one gas fire in continuous use in a living room, and other gas fires used intermittently. The lighting load was considered to be too insecure to be included in the calculations.

The author had in mind the average domestic consumption of 54,000 cu.ft. per annum at Bath as a goal to be reached, but the estimated possible consumptions so far exceeded this figure that the prospects were almost frightening in their immensity.

The following calculation indicated that when Gas dis-

TABLE 4.—*Provisional Rate Structure for Two-Part Tariff; Rotherham Corporation Gas Department.*

BASED ON NATIONAL GAS COUNCIL REPORT OF THE COMMITTEE ON GAS CHARGES AND THE ANNUAL ACCOUNTS OF THE DEPARTMENT FOR 1931–32.

—	Percentage Allocation.		Money Allocation.	
	Service	Commodity	Service.	Commodity.
1	2	3	4	5
	Per Cent.	Per Cent.	£	£
MANUFACTURE—				
Purchase of crude gas	..	100	..	7,860
Salaries	..	100	..	193
Purification	..	100	..	466
REPAIRS TO WORKS—				
Buildings and roads, &c., 80/20	50	50	915	914
Plant and machinery 10/90				
Gasholders, &c., 80/20				
DISTRIBUTION—				
Salaries	90	10	302	33
Mains and services repairs	60	40	2,100	1,401
Meter repairs	100	..	4,572	..
RATES	50	50	1,881	1 881
MANAGEMENT—				
Salaries of officers	60	40	1 215	810
Meter Collectors	100	..	2,280	..
Central est. charges	100	..	1,845	..
Stationery and advertising	60	40	496	331
Establishment charges	60	40	1,448	966
National Insurance	50	50	188	189
Superannuation	50	50	217	218
Allowances	50	50	417	417
Legal	60	40	215	144
Show-rooms	100	..	380	..
REDEMPTION OF DEBT	50	50	3.956	3 956
INTEREST	50	50	2,576	2,577
BANK INTEREST	50	50	56	57
INCOME TAX	25	75	979	2 940
Total			£26 038	£25 353

Service charge = $\frac{£26,038}{21,500 \text{ consumers}}$ = 24s. 3d. per annum = 5·6d. per week per consumer.

Commodity charge = $\frac{£25,353}{336 \text{ mill. cu.ft.}}$ = 18·1d. per 1,000 cu.ft.

TABLE 5.—*Estimate of Possible Consumption for Family of Four living in Average Six-Roomed House.*

(*a*) Average COAL used per week—Winter, 3 cwt. × 30 weeks = 90 cwt.
" " " —Summer, 1 cwt. × 20 weeks = 20 "

Total Coal Used Annually 110 cwt.
Plus GAS 18,500 cu.ft.

(*b*) With ALL-GAS Equipment—

	Cu.Ft. per Hour.		Hours per Week.		Weeks per Year.		Cu.Ft. per Year.
COOKER—							
Hotplate	25	×	10	×	50	=	12 500
Oven	20	×	8	×	50	=	8 000
WASH BOILER	60	×	2	×	50	=	6,000
GAS FIRES—							
Living room	30	×	60	×	30	=	54 000
Bedrooms	30	×	8	×	30	=	7,200
HOT WATER CIRCULATOR—Average of several installations						=	50,000
Total Annual Consumption							137,700

placed coal entirely, there should be a definite numerical relationship between the coal displaced and the Gas used to displace it. This seemed to be in the neighbourhood of 1,000 cu.ft. of Gas (5 therms) to 1 cwt. of coal.

1 lb. coal = 13,000 B.Th.U.
1 cwt. coal = 1,456,000 B.Th U.
*Efficiency of coal fire 8-25 per cent., average 20 per cent.
*Efficiency of gas fire 55 per cent.
Gas (500 B.Th.U.) required to displace 1 cwt. coal

$$= \frac{1.456\,000 \times 20}{55 \times 500} = 1{,}058 \text{ cu.ft.}$$

Note.—The coal fire also provides hot water intermittently, but on the other hand is often burning and heating the room unnecessarily. A gas fire can be turned down, and the Gas saved compensates for that used in heating water. The above equation is thus approximately correct.

If the calculated possible consumption of Gas was achieved by the complete displacement of coal, the allocation of charges given in the National Gas Council Report would make Gas more costly than coal at 1s. 5d. per cwt. (Rotherham prices ranged from 1s. 3d.-1s. 7d. per cwt.). In addition there would be the cost of installing the necessary gas appliances.

The National Gas Council scale would therefore make the ideal impossible, or at least improbable, of achievement.

(3) THE ROTHERHAM TARIFF STRUCTURE.

Bulk supplies of Gas to large industrial consumers, the Corporation had decided some time before, would under certain conditions be supplied purified at a cost of 10d. per 1,000 cu.ft. (2d. per therm). Why should not domestic consumers have Gas at this low price provided they paid a suitable Service Charge?

What Service Charge would be necessary?

A process of trial and error showed the costs which could be covered by a Commodity Charge of 10d. per 1,000 cu.ft. and those remaining to be covered by the Service Charge. These were compared with Table 4. The National Gas Council allocations were criticized and it became difficult to understand how 40 per cent. of the cost of main and service repairs could vary directly as the quantity of Gas passed while the cost of meter repairs was entirely independent of the quantity of Gas measured. In the case of an undertaking such as Rotherham, there seemed to be little justification for suggesting that 50 per cent. of the interest and redemption of debt varied directly as the quantity of Gas sold. Every item of the schedule was similarly examined, and it was finally decided to charge to "Commodity" all expenditure in the revenue account under the headings of Purchase of Crude Gas, Works Salaries and Wages, Purification, Repairs of Works and Plant, and Meter Repairs, and to allocate all other costs to a standing Service Charge. Provision for future development was made on the assumption that 100 per cent. increase in output would necessitate a 25 per cent. increase in capital and overhead costs. The result is shown in Table 6.

TABLE 6.—*Rate Structure of Two-Part Tariff; Rotherham Corporation Gas Department.*

BASED ON ANNUAL ACCOUNTS 1931–32.

Heading.	Total Expenditure.	Proportion Allocated to Domestic.	Amount Charged.
1	2	3	4
Purchase of crude gas	£17,867	See *Table 3*. 336/764	£7,860
Other works costs	4,147	60 per cent.	2,488
Meter repairs (slots)	4,133	100 "	4,133
Meter repairs (ordinary)	731	60 "	439
			£14,920
Balance of distribution costs	5,104	80 "	£4,083
Rates	4,704	80 "	3.763
Management	13,407	85 "	11,396
Redemption of debt	9,888	80 "	7.910
Interest	6,582	80 "	5,266
Income tax	5,599	70 "	3,919
Net profit	5,529	90 "	4,976
			£41,313
For future development add		25 "	10,328
			£51,641

Service charge = $\frac{£51,641}{21,500 \text{ consumers}}$ = £1 8s. per year = 11·1d. per week per consumer.

Commodity charge = $\frac{£14.920}{336 \text{ mill. cu.ft.}}$ = 10·65d. per 1,000 cu.ft.

NOTE.—Similar calculations on the 1934–35 accounts give—
Service charge £2 7s. 10d. per year = 11·0d. per week;
Commodity charge = 10·39d. per 1,000 cu.ft.

A "Scale of Charges" for the Two-Part Tariff was then drawn up, and here the author made two departures from the calculations which can only be justified by local economic circumstances.

The additional cost of attending to and collecting from prepayment meters is essentially an overhead charge, but the public are so accustomed to pay more for their gas through prepayment meters that although the additional cost had already been included in calculating the Service Charge, a differential of 2d. per 1,000 cu.ft. was added to the Commodity Charge in the case of slot meters. There is an existing differential of 4d. per 1,000 cu.ft. in the standard scale of charges and the slot meter consumption accounts for over 72 per cent. of the total domestic sales.

The other departure was in the gradation of the Service

* Given by Dr. D. A. Winter, of Radiation Ltd.

Charge to houses of different sizes. A large house has a greater capacity for gas than a small house, necessitating greater main capacity, larger service pipe and larger meter, but quite frankly the scale was made steep by assuming an ability to pay (see Table 7).

TABLE 7.—*Scale of Charges; Rotherham Corporation Gas Department.*

STANDARD PRICE OF GAS.

	s.	d.		
In the Borough	3	0	per 1,000 cu.ft.	(7·2d. per therm)
Wickersley, Catcliffe, and Treeton	3	6	,, ,,	(8·4d. ,,)
Hooton Roberts and Conisbro'	5	0	,, ,,	(12·0d. ,,)

Slot meters 4d. per 1,000 cu.ft. extra.

ALTERNATIVE SYSTEM FOR DOMESTIC CONSUMERS.

The Two-Part Tariff consists of:—

A Standing Weekly "SERVICE" Charge (according to Scale below) and a "COMMODITY" Charge for all gas consumed

Of 10d. per 1,000 cu ft. (Slot Meters, 1s. 0d. per 1,000 cu ft)

N.B.—Prepayment Consumers must pay the Service Charge weekly.

SCALE OF WEEKLY SERVICE CHARGES.

—	Borough. Per Week.	Wickersley, Catcliffe, Treeton, Per Week.	Hooton Roberts and Conisbro', Per Week.	Yearly Consumption required in Rotherham to get advantage from Scale.
1	2	3	4	5
	s. d.	s. d.	s. d.	
Houses with not more than 4 principal rooms.	0 10	1 0	1 6	20 000
Houses with 5 or 6 principal rooms	1 0	1 3	1 9	24 000
Houses with 7 or 8 principal rooms	1 3	1 6	2 0	30,000
Houses with 9 or 10 principal rooms	1 6	2 0	2 6	36,000
Houses with more than 10 principal rooms.	2 0	2 6	3 0	48,000

Principal rooms include all living rooms, bedrooms, large box rooms, cellars, &c., but not bathrooms or wash-houses.

The Commodity Charge was made to apply both in the Borough and also in the out-districts where there are different standard prices of Gas. The existing differential prices were translated for the Two-Part Tariff into Service charges by multiplying the average consumptions per consumer in the out-districts by the differential price charged.

The number of rooms in a house was considered to be the basis of the Service charge most likely to be understood by the small consumer—a four-roomed house giving a mental picture to many who do not know the rateable value of their dwellings. The rateable value of similar houses varies with different locations in the same town, and assessments vary from time to time. Calculations about floor areas, cubic contents, numbers and sizes of appliances, &c., tend to arouse a suspicion that the Gas Authority is juggling with figures to the disadvantage of the consumer.

The scale was then applied, by calculation, to a number of typical consumers, allowance being made for the cost of installing various gas appliances. The results were sufficiently satisfactory for a complete scheme to be drafted for submission to the Borough Treasurer who reported favourably, and the Gas Committee was asked to authorize its application.

The Town Clerk meanwhile had investigated the legal aspect. Consultations were held with the National Gas Council and with the Board of Trade; the Corporation also took the opinion of Counsel. This was before any report on the subject had been published by the Gas Legislation Committee of the Board of Trade. It was finally decided to make use of the powers available under Section 13 of the Gas Works Clauses Act, 1847, adding a Clause in any agreement made with a consumer safeguarding him against being called upon to pay more than the statutory maximum price for the Gas used.

THE TWO-PART TARIFF IN OPERATION.

Although a multiple tariff has been used by the Electricity Department for many years and is understood by the public, the idea of a similar tariff for Gas was so revolutionary that the Corporation was somewhat fearful as to its effect on both the Department and the consumer. As the Tariff had developed out of a difficulty on one of the Corporation's Housing Estates, authority was given to experiment with the Tariff on a small number of Corporation tenants.

The Housing Department was asked to nominate a number of tenants from whom the author selected ten as typical of a wide range of cases—large and small families, those who already used Gas freely and those who used none, parlour and non-parlour houses, unemployed labourers and "black-coated" workers. In each case the consent of the tenant was obtained, and the Gas Department undertook to instal all the gas appliances necessary to displace coal entirely and, if required to do so by the tenant at the end of the test, to remove the gas appliances and reinstate the original coal equipment free of cost to the tenant and to the Housing Committee. The Gas Department also gave a guarantee that the cost of Gas on the new Tariff Scale during the test period should not exceed the cost to the tenant of coal and gas during the corresponding period of the preceding year. No rental was charged for the appliances during the test period.

The equipment installed in each case was in accordance with the following standard. In place of the kitchen range, a nine radiant "Duplex" gas fire in an oak mantel with tiled surround was installed. In the bathroom, a water heater with automatic pressure cut-off valve; the hot water cylinder and the flow and return pipes were insulated. In the scullery a gas cooker with thermostatic oven control, a wash boiler and gas fired incinerator; in the sitting room, a seven radiant gas fire, and in the bedrooms as many five radiant gas fires as required. Each house was supplied with a high capacity meter (100 cu.ft. per hour) fitted with a shilling-in-the-slot attachment and set to supply 720 cu.ft. for one shilling. The existing one inch service pipe was found to be adequate. Any existing appliances of an old pattern or not up to standard were replaced free of charge. The tenants' own estimates of previous coal consumptions were accepted in every case.

The test period was three months from 1st October to 31st December, 1932.

A number of other houses, privately owned, were also accepted for test without any distinction as to appliances installed and without any guarantee or financial assistance from the Gas Department.

In every case the consumer expressed his satisfaction, and those in the Corporation houses under test agreed to pay a rental for the appliances fixed, so as to continue on the Two-Part Tariff.

Meanwhile, a considerable number of applications for the Tariff Scale were received from other consumers. The Corporation decided to continue the main test for a complete twelve months from 1st January, 1933, and authorized the acceptance of applications provided the consumer paid for any equipment installed and for all work done. An additional 101 applications were accepted without any obligation on the consumer to convert from coal to Gas, and in some cases no additional appliances were installed. This made a total of 134 consumers on the Two-Part Tariff. The spirit of the whole scheme was freedom of choice and an absence of any restriction which would tend to make the consumer suspicious. The results of the twelve months' test are given in Table 8.

It is interesting to note in the case of the original ten test houses, that the consumption of Gas during twelve months worked out at an average of 1,018 cu.ft. (5·09 therms) per cwt. of coal displaced, compared with the estimate of 1,058 cu.ft.

The collection of the Service Charge from prepayment consumers was an interesting problem—but not the most difficult. The National Gas Council Report of the Committee on Gas Charges, 1928, said such collection was impracticable; but, while the methods in use at Rotherham may become unwieldy if attempted on a large scale, there is no doubt that the application of a Two-Part Tariff to prepayment consumers has lost a lot of its terrors.

In the case of the ten test houses on the Corporation estates, arrangements were made for the Service Charges to be collected weekly by the rent collectors and credited to the Gas Department. This arrangement has been extended to cover all Corporation tenants who have since signed Two-Part Tariff agreements. The Gas Department allows the Housing Department 5 per cent. commission on the money collected.

When other prepayment consumers applied for, and in some cases demanded, the Two-Part Tariff, they were asked to call weekly at the Gas Offices to pay the Service Charge in advance. The payments were acknowledged in an ordinary rent book. The procedure was so simple and the results so effective, that it was extended to all applications from prepayment consumers, the periods of payment being increased to two or more weeks at the option of the consumer when signing the agreement. More recently, in order to meet the convenience of consumers living at a distance from the Gas Offices, recording collecting boxes are loaned to the consumer and opened by the visiting meter inspector when attending to the meter. The use of the collecting box was copied from the Stretford and District Gas Board where it was introduced by Col. W. Moncrieff Carr, the President of the Institution. A more

TABLE 8.—*Summary of Twelve Months Test of Two-Part Tariff Experiment: Rotherham Corporation Gas Department.*

Type of House.	No. under Test.		Jan.-Dec., 1932.		Jan.-Dec., 1933.	
	Slot.	Ordinary.	Gas Used.	Revenue.	Gas Used.	Revenue.
1	2	3	4	5	6	7
			Cu.Ft.	£ s. d.	Cu.Ft	£ s. d.
Non-parlour	8	..	93,200	15 10 5	749,500	52 13 8
Parlour	15	3	315,400	52 3 4	1,014 100	88 1 2
Up to 4 rooms	10	2	156,320	26 5 5	392,850	40 9 5
5 and 6 rooms	42	34	1,169,135	206 19 9	3,154,800	291 3 5
7 and 8 rooms	4	9	253,200	41 13 6	914 400	72 4 11
9 and 10 rooms	..	1	14,900	2 6 9	27,400	3 1 10
Over 10 rooms	1	5	87,500	13 19 3	507,900	36 6 1
	80	54				
Total	134		2,089,655	£358 18 5	6,760,950	£584 0 6
Average			15,600	£2 13 7	50,500	£4 7 2

Extra gas purchased, 4,671,395 cu.ft. at 6d. per 1,000 cu.ft. £116 15s. 9d.

Year's revenue, 1933	£584 0 6
Year's revenue, 1932	358 18 5
	£225 2 1
Extra gas cost	116 15 9
Increased net revenue	£108 6 4

recent development is the savings box attached to the meter cash box.

A report on the twelve months' test was submitted to the Gas Committee which recommended the Town Council to authorize the Two-Part Tariff as an optional method of charge to all domestic consumers. The Electricity Committee raised severe opposition, on the ground that the availability of cheap Gas would be detrimental to the development of the sale of electricity for household purposes—the right of the consumer to have cheap Gas as well as cheap electricity appearing to be a secondary consideration. The matter was referred to a Joint Gas and Electricity Sub-Committee, which considered a report by the Borough Treasurer on the financial aspects and finally approved the Gas Committee's recommendation. Thus, with the Council's authority, the Two-Part Tariff was made available to all domestic consumers on 1st February, 1934.

Up to the 31st December, 1935, the total number of agreements signed was 1,274 (360 Ordinary and 914 Slot). Of these, 68 have lapsed due to removal from the town, 28 by consumer's request and 37 by failure to pay the Service Charge regularly, leaving a total of 1,141 (337 Ordinary and 804 Slot) still in operation. The number continues to increase more or less steadily at the rate of 40 per month.

The effect of the Two-Part Tariff on the consumptions of those consumers who were on the Two-Part Tariff during each 12 months' period is shown in Table 9.

TABLE 9.—*Effect of Two-Part Tariff on Consumers; Rotherham Corporation Gas Department.*

Annual Consumption.	Year to 31st December, 1933.		Year to 31st December, 1934.		Year to 31st December, 1935.	
	Previous Year on Flat Rate.	On T P T.	Previous Year on Flat Rate	On T.P.T	Previous Year on Flat Rate.	On T P.T.
1	2	3	4	5	6	7
Under 4,000 cu.ft.	1	..	1	..	1	..
4 000- 7,000 ,,	4	..	8	..	11	..
7,000- 10,000 ,,	14	..	20	1	24	1
10,000- 17,000 ,,	31	5	60	6	111	19
17,000- 25,000 ,,	19	17	72	33	140	62
25,000- 50,000 ,,	51	39	108	130	193	233
50,000-100,000 ,,	11	43	41	107	55	157
Over 100,000 ,,	3	30	10	43	14	77
Total	134	131	320	320	549	549

It can be claimed, therefore, that the Rotherham Two-Part Tariff appeals to all classes of consumer and the danger of wholesale reductions in revenue is not actually very serious. Calculations at Rotherham indicated a maximum possible loss of £4,933 per annum. So far, there has been no loss of revenue but an increase, and the increase has more than covered the additional expenditure incurred.

A loose-leaf rental book is used to record all Two-Part Tariff consumers, and from that record the quarterly summaries, given in Table 10, have been extracted.

The increased expenditure incurred by the Department

TABLE 10.—*Annual Results of Two-Part Tariff: Rotherham Corporation Gas Department.*

Year Ending 31st December, 1933.

Quarter.	Number during the Quarter.		Pre-Tariff.		Tariff.	
	S.	O.	Consumption.	Revenue.	Consumption.	Revenue.
1	2	3	4	5	6	7
			Cu.Ft.	£ s. d.	Cu Ft.	£ s. d
March	27	6	186,400	30 8 11	863 000	62 1 0
June	68	39	590.400	96 3 6	1,423 800	138 12 1
September	81	49	527 600	87 19 11	1 225 800	141 15 0
December	80	54	785 200	144 6 1	3,248 200	241 12 5
Totals	134		2 089 600	£358 18 5	6 760 800	£584 0 6

Average price of gas, pre-tariff 3s. 5d.; Tariff 1s 9d.

Cost of extra gas at 6d. per 1,000 cu.ft. £116 15s. 7d. Increased NET revenue £108 6s. 4d.

Year Ending 31st December, 1934.

Quarter.	Number.		Pre-Tariff.		Tariff	
	S.	O.	Consumption.	Revenue.	Consumption.	Revenue.
1	2	3	4	5	3	7
			Cu Ft.	£ s d	Cu Ft.	£ s. d.
March	77	54	1 094 000	177 13 7	3 058 300	213 1 1
June	247	139	2 4 6.700	394 14 2	5 444 200	522 8 2
September	278	166	2 346 900	393 1 2	3 880 200	504 2 5
December	406	207	4 870 800	795 14 1	8 635 500	787 12 4
Totals	613		10,728 400	£1 761 3 0	21 018 200	£2 027 4 0

Average price of gas, pre-tariff, 3s. 3d; Tariff, 1s. 11d.

Cost of extra gas at 6d. per 1,000 cu.ft. £257 4s. 11d. Increased NET revenue £8 16s. 1d.

Year Ending 31st December, 1935.

Quarter.	Number.		Pre-Tariff.		Tariff.	
	S.	O.	Consumption	Revenue.	Consumption	Revenue.
1	2	3	4	5	6	7
			Cu.Ft	£ s. d.	Cu.Ft.	£ s. d.
March	603	244	6,622.800	1,083 12 4	14.312.700	1,260 16 5
June	673	277	5 777 000	959 15 4	11 947.800	1,242 15 5
September	705	297	5.719 000	958 9 2	8 452,000	1,118 17 5
December	793	328	8,756 000	1.517 2 6	15 582,000	1.528 0 0
Totals	1,121		26 874 800	£4 518 19 4	50,294.500	£5.150 9 3

Average price of gas, pre-tariff, 3s. 4d.; Tariff, 2s.

Cost of extra gas at 6d. per 1 000 cu.ft. £585 9s. 9d. Increased NET revenue £46 cs 2d.

and charged against the increased revenue, as determined by the Borough Treasurer is as follows:

	Per 1,000 Cu.Ft. d.
Crude gas purchased at average price of	5·43
Cost of purification	0·07
Cost of collection	0 47
Total	5·97

That is, approximately, 6d. per 1,000 cu.ft. for all the increased consumption by Two-Part Tariff consumers.

Actually, up-to-date, no additional workmen or staff have been required.

Although the increase in the total net profit to the Department resulting from the application of the Two-Part Tariff is small, the Tariff is proving to be of real advantage. It has unquestionably stopped the transfer of many domestic consumers to electricity and it is opening up the domestic field for greatly increased consumptions of Gas. It is materially assisting smoke abatement. It is self-energizing, in that satisfied consumers recommend it to their friends. It is making the public gas-minded, and it is producing additional net profit. Therefore it is a success.

When the scheme was designed, it was considered that during the first few years, 2,500 consumers, say, 10 per cent. of the total, would be likely to sign agreements. If, during that time their average consumption increased by 300 per cent., this would mean that the Gas Works Plant would have to deal with an increase of approximately 4 per cent. per annum. As the output of the Department is already increasing, thanks to the industrial load, by over 12 per cent. per annum, which necessitates increases of plant from time to time, the cost of providing for the effect of the Two-Part Tariff would be comparatively small.

The effect on the Distribution System is even less. Comparison of the appliances in use by the consumers before and after signing the Two-Part Tariff agreements, shows that their hourly peak load consumption is increased by 50 per cent. or less. The effect of this increase by 2,500 consumers related to the estimated present peak load on the Distribution System is so small as to be negligible, about 1 per cent.

In any case, the inclusion in the Service Charge of 25 per cent. of all overhead expenses, as shown in Table 6, should be ample for any increase of plant and mains.

COLLATERAL EFFORTS.

(1) Maintenance.

Maintenance of consumers' apparatus is absolutely necessary. A maintenance scheme for the whole Department is gradually being built up as gas fitters' apprentices are trained. Maintenance work is a stage in the training, those showing sufficient qualifications being allowed to go forward in their training to be tradesmen. At present about one-third of the consumers are visited every twelve months. In the case of the Two-Part Tariff consumers, however, more expert maintenance men are used, and each consumer is visited every three months. The visit is free of cost to the consumer except for a small charge for materials used. A record is kept of all work done. It is noted that water-heaters, particularly, require frequent attention, and there is need for stronger gas-fire radiants.

(2) Hire-Purchase.

It is the considered policy of the Rotherham Corporation that gas and electricity appliances are to be sold outright or by hire-purchase agreements. There are a few exceptions, including old simple-hire cookers and fires still in circulation. The number of these is being reduced by scrapping some and by reconditioning others for disposal on hire-purchase terms. Hire-purchase agreements are normally for three, five, or seven years, but during the last twelve months, alternative hire-purchase agreements at 6d. or 1s. 0d. per week have been offered. These have proved remarkably successful. They make a strong appeal to the consumer, and the result to the appliance firms is very satisfactory. Hire-purchase instalments are normally recoverable out of slot meter rebates, but recently the Department has offered to assist consumers by loaning to them collecting money boxes similar to those used for Two-Part Tariff collections. The hire of the boxes consists of two weeks' rental of the appliances (6d. or 1s. 0d. per week) for each year of the period of the hire-purchase agreement.

In the case of all-gas equipment in Corporation houses, a concession to the consumer has been granted in that the living room fire and hot water circulator are treated as "landlords' fixtures" and the tenant is charged simple hire only. He pays hire-purchase instalments on other appliances which are considered to be "tenants' fittings." The total payments for simple hire and hire-purchase for a converted all-gas house average 13s. 0d. per quarter.

(3) Canvassing.

With a view to holding a balance between the Gas and Electricity Departments, the Corporation frowns on direct canvassing by Corporation employees, and prohibits the payment of commissions. The fact that every wireless dealer and so-called electrical engineer in the town is a canvasser for the Corporation's Assisted Wiring Scheme, &c., makes the arrangement rather favour the Electricity Department, but as the Gas Department has over 150 loyal members of the Staff and Workmen who are encouraged to take an interest in their job and to talk Gas at every opportunity, the balance is perhaps not so very much one-sided.

(4) The Gas Unit.

In order to assist the staff in combatting electrical competition, the author recommended the Gas Committee to adopt, for advertising purposes only, a Gas Unit of 4,000 B.Th.U. Considerable opposition arose from the Electricity Committee on the ground that as "unit" was an electrical term, the Gas Unit would be misleading to the public. The question was referred to the Joint Gas and Electricity Sub-Committee, which decided in favour of the Gas Committee's recommendation. Quite frankly, it is difficult to say definitely after twelve months' use that the adoption of the gas unit has materially affected the sales of apparatus or increased the sales of Gas.

(5) Advertising.

The appeal to consumers to adopt the new Two-Part Tariff methods of charging for Gas has been confined almost entirely to press advertising, posters, and explanatory pamphlets, backed up by the usual show-room methods. There was a definite desire that consumers should want the tariff on the recommendation of their friends rather than that they should suspiciously accept something they did not understand. It was also desired that the scheme should develop within the capacity of the existing staff to deal with it. The result may not be spectacular from the point of view of numbers, but there is no denying the solidity of the structure which is steadily being erected.

WHAT OF THE FUTURE?

As far back as 1892 certain gas companies put a multiple tariff into operation, and in 1905 the late Mr. S. Meunier referred to the advisability of some alternative to the flat rate system of charge. In 1912, Mr. W. B. McLusky instituted an optional Two-Part Tariff at Halifax and the Gas Industry owes much to his pioneer work. In 1927, Todmorden offered an alternative Two-Part Tariff and since then schemes have been devised by Bradford, Macclesfield, Newcastle, and others. More recently several tariff scales based on the Rotherham scheme have been offered, and the seal of approval has been put on the question by the adoption last October of a Two-Part Tariff by the Gas Light and Coke Company. If anything further were required to convince the sceptic, there is the recent report of the investigations carried out by the Joint Co-ordinating Committee of The Institution of Gas Engineers, the National Gas Council, and the British Commercial Gas Association.

Meanwhile the number and variety of tariffs in the Gas Industry are growing. Is the Industry likely to get into the difficulty which is now causing the Electrical Industry so much concern—too great a variety of tariffs?

With a view to avoiding such a difficulty, the author asks for careful consideration of the following notes:

1. The reduced consumption per consumer during recent years calls for some action.
2. The present electrical competition is likely to be intensified.
3. An increased consumption of Gas in the domestic field must be chiefly at the expense of coal and in the industrial field at the expense of coal and oil.
4. Ten domestic consumers each with an annual consumption of 100,000 cu.ft. are better than one industrial consumer taking 1,000,000 cu.ft.
5. For industrial purposes, both coal and oil are sold at more or less standard regional prices, and to compete successfully, Gas must be sold by all Undertakings at equivalent standard regional prices. These range from 2½d. to 4d. per therm.
6. For domestic purposes 1,000 cu.ft. of Gas (5 therms) will do the work of 1 cwt. household coal. The local price of household coal per cwt. bag thus determines the value of Gas—in Rotherham 1s. 5d. per 1,000 cu.ft., Manchester 1s. 9d. per 1,000 cu.ft., and London about 2s. 3d. per 1,000 cu.ft. These include Service and other charges, so that the Commodity Charge must range from 1s. 0d. to 1s. 8d. per 1,000 cu.ft. (2½d. to 4d. per therm).

7. Gas is produced by most Undertakings at a cost into holder of 3d. to 4d. per therm. These costs could be reduced by a better load factor and increased output.
8. Actual experience indicates that the following consumptions are obtainable with Gas at a "competitive" price:

Artisan cottage property	120 000 cu.ft. per annum
Middle class houses	180,000 ,, ,,
Larger houses	350,000 ,, ,,

9. It would seem that many Undertakings could adopt with advantage a Domestic Two-Part Tariff competitive with local coal, made up, approximately, of:

Standing charge	10–15 per cent. of rateable value
Commodity charge	3d. to 3½d. per therm

10. Tariff Systems with a Commodity Charge of 6d. per therm in addition to the Service Charge are not competitive.
11. If a properly proportioned Service Charge could be calculated, and if every consumer paid his correct proportion of the cost of giving a supply irrespective of his consumption, then every consumer, domestic and industrial, could have his Gas at the same "Commodity" Flat Rate—manufacture cost *plus* a margin of profit.
12. The Gas Industry might usefully concentrate on selling Gas, and not dissipate its energy by trying to sell two competitive fuels—Gas and Coke—to the same consumer for the same purpose.
13. Greater attention is required by gas appliance makers to produce domestic appliances capable of continuous use over long periods without attention.

The author has been criticized for calculating his rate structure in the manner of a schoolboy with a book of answers. At least the results indicate that the answer is correct!

(Communication No. 133)

Heating Problems Arising in Industrial Gas Sales

By T. H. PARDOE

(Chief Industrial Gas Engineer, Stretford and District Gas Board)

Prior to joining the Gas Industry, the author was employed by a firm of furnace manufacturers, and emphasizes that, in these days of fierce competition, it is essential that a gas salesman should know not only the details of his own job but also of what competitors are capable. The Gas Industry has tended to under-rate its competitors in that it has not been sufficiently concerned with their developments. This can partly be explained by the fact that most of the members of industrial gas sales staffs are products of the Gas Industry, and probably not more than 5 per cent. have operated furnaces on oil, bituminous and anthracite producer gas and raw fuel; their knowledge of furnaces using competitive fuels is largely theoretical. The author considers that all industrial gas salesmen should have practical experience in the operation of furnaces on other fuels.

The knowledge of furnaces using competitive fuels greatly increases a salesman's prestige when interviewing prospective customers, for he is able to put his finger on the very spot where competitive fuels may fail in the particular application under discussion. The salesman who can discuss alternative fuels with equal knowledge can more easily satisfy a customer that he is getting a fair and logical statement of town gas and not a lot of high pressure hot air from a super salesman.

This raises two questions:—

(*a*) How is the industrial sales staff to get a practical experience of competitive fuels used in industrial furnaces?

(*b*) Is such experience necessary, or can sufficient knowledge of the subject be gained from technical literature?

In answer to the first question, the author maintains that any junior joining the industrial sales staff of a gas undertaking should, if possible, first serve as a pupil with a reputable furnace manufacturer engaged in the production of furnaces for all fuels. He would then be made to realize fully the classes of work to which competitive fuels are particularly suited and, what is very important, he would also get a commercial grounding.

In reply to the second question, whilst practical experience is not actually essential it is a valuable asset, giving one a broader view and a better balance of judgment.

It is extremely useful and interesting to read in the technical press of visits made to various works by Junior Gas Associations and Salesmen's Circles. These visits are usually to works where Gas is being used on industrial equipment and are of great educational value. But, in addition, an effort should be made to inspect works which are using competitive fuel such as producer gas and oil, after which a discussion should invariably follow, when the advantages of town gas for furnaces doing a similar duty should be explained.

The value of familiarity with competitive fuels cannot be over-rated; the author believes that all information and statistics relating to industrial gas equipment given at any meeting of the Gas Industry is carefully filed on the files of the electrical and oil industries.

The industrial gas salesman must be careful in assessing the value of competitive fuels. For example, when a new gas furnace is installed to replace an old one on some other fuel, an increased efficiency is generally obtained, not necessarily represented by cost of fuel per ton of product treated, but also in the improved quality and finish. This increase in efficiency can give a false sense of security and satisfaction and it is easy to imagine an industrial salesman sending in his monthly report that he has just installed a new gas furnace to replace one fired by competitive fuel and has reduced the customer's costs by 30 per cent. The wise salesman is only satisfied and content to base his business approaches on a comparison made between a new gas furnace and a new furnace using competitive fuel, as it is only by such comparison that one is able to judge the relative position of the Gas Industry to its competitors. The modern solid fuel fired furnace is vastly superior to its predecessors, and is not the tumbledown mass of brickwork, smoke and ashes that was once a familiar object in many works; they can and do produce excellent work and are usually installed where town gas is prohibitive in price and where ground space is not at a premium.

Let the Gas Industry see that these installations of raw fuel, producer gas and oil fired furnaces are cut down to a minimum by giving its industrial sales staff a real chance—by offering cheap gas.

The price of gas enters seriously into all industrial sales considerations, and special contracts at a price to meet the requirements of the process are often justified if the load factor is satisfactory. It is important to remember that once a large amount of capital is invested in new plant using a fuel other than gas, the competitive position is infinitely worsened, for if, at a later date, cheap gas is offered, the consumer cannot accept the offer because he is faced with the cost of scrapping existing plant. Cheap industrial gas now means growing gas sales.

Furnace makers will give 100 per cent. backing to gas undertakings who offer Gas for industrial processes at competitive rates, for they fully realize what a perfect fuel town gas is.

Complaints of a certain Gas Engineer that a furnace maker has been selling oil or producer gas furnaces in his area have shown, on enquiry as to the price of gas, that it was not being sold at competitive rates and that the furnace maker was forced to offer another fuel. Except in a few notable instances, gas undertakings generally are

missing an opportunity to secure a sound industrial load by fixing gas charges on an erroneous basis that no industry can afford to pay.

The tendency of some gas undertakings to manufacture and supply their own furnaces is alarming, except special appliances for exceptional requirements. If this tendency is developed, it may prove to be a two-edged weapon in that it will tend to drive furnace makers into our competitor's hands.

The Gas Industry must accept responsibility for the suitability of any installation it recommends and the closest liaison is necessary with the furnace manufacturer to maintain the consumers' good will.

The furnace makers carry large technical and estimating staffs, and they have done considerable pioneer and development work on industrial furnaces and processes which has ultimately been of great benefit to the Gas Industry; the desirability of co-operation for mutual interest cannot be over-emphasized. It is true that development work has not been so intense on the town gas side of their business, but this is largely the fault of the Gas Industry, for it would be commercial suicide for a furnace maker to concentrate on the development of furnaces using town gas at from 6d. to 10d. per therm when his competitors were selling furnaces for similar work using other fuel at a cost equivalent of from 3d. to 5d. per therm.

I would express my gratitude to Colonel W. Moncrieff Carr, O.B.E., T.D., M.Inst.Gas E., for granting me permission to present this Paper, and for his assistance in its assembly.

RAILWAY CARRIAGE TYRE HEATING.

Among the many difficult articles which the Industrial Gas Department of the Stretford Undertaking is called upon to heat is the railway carriage tyre, which, by virtue of its shape, is not easily handled and occupies about 15 per cent. of the floor space in a rectangular furnace and 25 per cent. in a circular furnace.

The tyre manufacturers, however, have developed remarkable and ingenious handling facilities and it is largely owing to these that the vertical pit type of tyre furnace has proved successful.

The furnace, illustrated in Figure 1, is fired with self-proportioning air gas mixture burners and is of the pit type (down draught), 6 ft. 6 in. diameter, 4 ft. 9 in. deep, with 9 in. firebrick lining and 3 in. insulation, and is fitted with a removable cover. Eight tyres are charged at a time and the test figures given in Table 1 indicate performance under continuous operating conditions. The burners are arranged around the outer periphery of the bottom tyre and the gases flow up the outer sides and down the inner sides of the tyres.

TABLE 1.—*Test on Railway Carriage Tyre Furnace.*

1	2
Furnace lighted up	1.30 p.m.
Number of tyres charged	8
Inside diameter of tyre	3 ft 1⅛ in.
Weight of tyres	2 tons
Furnace temperature when tyres charged	200° C.
Furnace temperature when tyres discharged	855° C.
Time of discharge	4.15 p.m.
Total gas used	11,150 cu.ft.
Calorific Value of gas	500 B.Th.U.
Efficiency, average	22 per cent.

The furnace makers had some trouble in maintaining a uniform temperature, but this was mainly due to burner equipment. When final adjustments had been made the results given in Table 1 were obtained.

The pit type furnace must have a quick sealing door, for otherwise as each tyre is discharged the temperature in the furnace will drop rapidly. Special consideration must also be given to charging and discharging apparatus.

There is no doubt that an increased efficiency could be obtained on a similar process but, as is often the case, the furnace was built to a price and no recuperators are fitted. Given a free hand in regard to cost there is no doubt that 35 per cent. efficiency could be obtained.

The furnace described operates in direct competition with producer gas fired furnaces and gives much better control, uniformity of temperature to within five degrees centigrade, and considerably less scale.

TABLE 2.—*Test on Cork Baking Ovens.*

1	2
Total weight of moulds	5,120 lb.
,, ,, ,, trucks	1,484 lb.
,, ,, ,, cork charged	704 lb.
,, ,, ,, cork discharged	512 lb.
Total gas consumption per charge	4,800 cu.ft.
Calorific Value of gas	500 B.Th.U.
Time of baking per charge	4 hr.
Gas used per pound of cork charged	608 cu.ft.
Working temperature	660°-680° F.
Heat in cork on discharge	112,000 B.Th.U. (= 224 cu.ft.)
Efficiency	4·67 per cent.

CORK BAKING.

In a battery of cork baking ovens at Stretford there are four chambers each designed to hold a truck containing eight cork slabs 3 ft. 0 in. × 2 ft. 0 in. × 4 in. in steel

FIGURE 1.—*Railway Carriage Tyre Heating Furnace, with self-proportioning air gas mixture burners; vertical pit type.*

FIGURE 2.—*Wire Annealing Furnace; vertical two-cell recuperative type.*

moulds. Table 2 gives the results of final acceptance tests, from which the process would seem to be very inefficient; a description of the process, however, indicates why the gas consumption per pound of cork is relatively high.

The cork is first received in granulated form and is poured into steel moulds, which have loose top and bottom plates. The cork is then subjected to a pressure of about 700 lb. per sq.in., which has the effect of so squeezing each particle together that in the subsequent baking process the expansion has the effect of making the cork almost homogeneous.

The moulds are placed in racks on the truck and charged into the oven. Each oven is of the recirculation type with provision for venting excess volatile matter and steam driven off the cork, and arrangements are also made for admitting additional fresh air. Thermostatic control is fitted, the maximum temperature being 680° F. Should the temperature exceed 700° F. firing of the cork is practically certain.

The loose cover plates on the moulds have only approximately $\frac{1}{32}$ in. clearance; consequently there is very little outlet for the volatile vapour and steam. As cork is a good insulator the temperature rise in the centre of the slab is very slow and the time cycle a long one. After charging, the ovens must be brought back to 680° F. in two hours, otherwise the 4 in. slabs will not be completely baked in the four-hour cycle.

An analysis of the cork is:—

Moisture at 105° C.	7·2 per cent. by weight	
Volatile at 800° F.—		
After 1 hour	61·6	,, ,,
,, 1½ hours	63·8	,, ,,
,, 1¾ ,,	63·8	,, ,,

When the ovens were first put into commission, considerable difficulty was experienced due to (*a*) insufficient burner capacity, (*b*) insufficient recirculation.

The ovens, however, are now working perfectly. The batch system gives great flexibility, enabling the manufacturer to vary the type of slab in any one oven.

The ovens are in direct competition with a coke fired furnace, and although the net fuel cost is approximately 14 per cent. higher, with gas at 4d. per therm, this is more than outweighed by the elimination of waste due to the burning, which in the solid fuel fired oven is approximately 10 per cent., and by the better product, ease of control and low handling costs. A further gas fired oven is under consideration. The cork slabs baked in this oven are for the insulation of large refrigerators.

VEGETABLE OIL HEATING.

In a paper read by Colonel W. Moncrieff Carr, O.B.E., T.D., President of the Institution, at the British Industries Fair, Birmingham, in 1933, particulars were given of the conversion of a coke fired vegetable oil heater to Gas when an efficiency of 67·3 per cent. was obtained. This conversion has proved so successful that it has been decided to instal an additional heater fired by town gas.

Consideration of the question of design led to the opinion that a fire tube heater would give equally satisfactory results and would afford a large saving in space. Designs were therefore prepared and a gas fire tube type of heater was installed in collaboration with a manufacturer of oil heaters.

This heater is thermostatically controlled and fitted with an induced draught fan so that draught conditions are constant. When the burners are cut off on thermostat the fan is stationary so that no heat is carried off by the chimney.

Figures obtained on a 24-hour test are given in Table 3. The efficiency was lower than anticipated owing to 3 per cent. carbon monoxide in the waste gas. This installation has just been put into operation, and steps have been taken to improve the combustion which should result in an overall efficiency of 68 per cent. The manufacturers have under consideration further heaters of this type.

TABLE 3.—*Test on Vegetable Oil Heater.*

1	2
Oil heated; 15 charges at 5 tons per charge	75 tons
Total gas consumed	58,325 cu.ft.
Calorific Value of gas	500 B.Th.U.
Gas per charge	3,888·3 cu.ft.
Inlet temperature of oil	97° C.
Outlet ,, ,,	190° C.
Efficiency	58·48 per cent.
Draught at fan	0·14 in. w.g.

WIRE ANNEALING.

A vertical two-cell recuperative gas fired furnace used for the close or pot annealing of steel wire and strip, at present in process of installation, is illustrated in Figure 2. Each cell is separately fired with natural draught burners and all secondary air is pre-heated. Due to the special design of the gas ports, great flexibility and uniformity of heating is assured. Another interesting feature is the special precautions that have been taken to prevent overheating of the pot.

Test figures from the furnace are not yet available, but

its size and performance is indicated by the following records:—

Pot Dimensions.
Small size = 2 ft. 9 in. diameter; 6 ft. 0 in. deep
Large ,, = 3 ft. 0 in. ,, 6 ft. 0 in. ,,

Cell Dimensions.
Inside diameter = 4 ft 3 in.; depth, 7 ft. 9 in.
Heating cycle = 6 hours.

	T.	Cwt.	Qr.
Approximate weight of 2 ft. 9 in. diameter pot	1	5	0
,, ,, ,, wire	1	8	0
Total	2	13	0

Annealing temperature = 750° C.
Total estimated gas consumption during six hours firing cycle = 6,500 cu ft.
Gross estimated efficiency = 37 per cent.
Net ,, ,, = 20 ,,

A great advantage of town gas for this type of work is that the atmosphere around the pot can be controlled at will, *i.e.*, oxidizing, neutral or reducing, and by using a maximum amount of pre-heated secondary air a long soft luminous flame is obtained. The pot in this furnace can be less in thickness than those in solid fuel furnaces, which gives quicker heating and cooling, a reduction in fuel consumption and longer pot life.

It is believed that there is no other furnace in the country doing similar duty and fired with town gas, so the final results are awaited with more than ordinary interest.

BRIGHT ANNEALING OF COPPER.

There are many methods of bright annealing copper, but one or other of the three processes discussed below is used by the majority of copper wire manufacturers.

(1) Steam Purged Continuous Muffle Furnace with Water Seals.
(2) "Barcro" Pot System.
(3) Electrical Bell Type Furnace, commonly called the Top Hat Furnace.

The relative advantages and disadvantages of each system can be listed as follows:—

(1) *Steam Purged Continuous Muffle Furnace with Water Seals.*

Advantages.
(*a*) The steam atmosphere is cheap.
(*b*) Simplicity of operation.
(*c*) Quick cooling.
(*d*) Capable of large outputs.
(*e*) Cheap fuel can be used.

Disadvantages.
(*a*) Wet annealing.
(*b*) Maintaining muffle temperature over week-ends.
(*c*) Space requirements.
(*d*) Static atmosphere.
(*e*) Radiant heat.

(2) *"Barcro" Pot System.*

Advantages.
(*a*) Dry annealing.
(*b*) Flexibility.

Disadvantages.
(*a*) Slow heating and cooling.
(*b*) Maintenance.
(*c*) Running cost.
(*d*) Static atmosphere and radiant heat.

(3) *Electrical Bell Type Furnace.*

Advantages.
(*a*) Dry annealing.
(*b*) Flexibility.

Disadvantages.
(*a*) High cost of fuel (at ½d. per unit equals 1s. 2½d. per therm).
(*b*) Static atmosphere.
(*c*) Slow heating and cooling.
(*d*) Radiant heat.

What then constitutes the ideal type of furnace? The following are some of the points to be considered:—

(1) The furnace should produce a perfectly dry bright annealed product.
(2) The atmosphere used in the furnace throughout the whole of the heating and cooling cycle should be chemically inert to the product being annealed.
(3) The furnace should be designed to operate on the cheapest atmosphere available (which is treated town gas).
(4) The retort or muffle in which the product is bright annealed should be arranged to prevent excessive loss of purging gas.
(5) The time cycle of cooling should not exceed that of heating.
(6) The heating up of the load should be done by convection not radiation.
(7) The furnace should have a high thermal efficiency.

Figure 3 shows a type of bright annealing plant which would fulfil all the conditions given, the full operating cycle being as follows:—The annealing chamber is loaded, the chamber door closed and made airtight. Valve A is now opened and the whole of the system is purged with a suitable bright annealing atmosphere. The gas burners which fire the heat exchanger are lighted. Valve C is opened; valve B closed, and the high capacity blower started. By this means the system is thoroughly scavenged of air, the high velocity atmosphere thoroughly scrubbing off those particles of air which cling to a coil of wire. After a definite time, determined by experiment, valves A and C are closed and valve B opened. There is

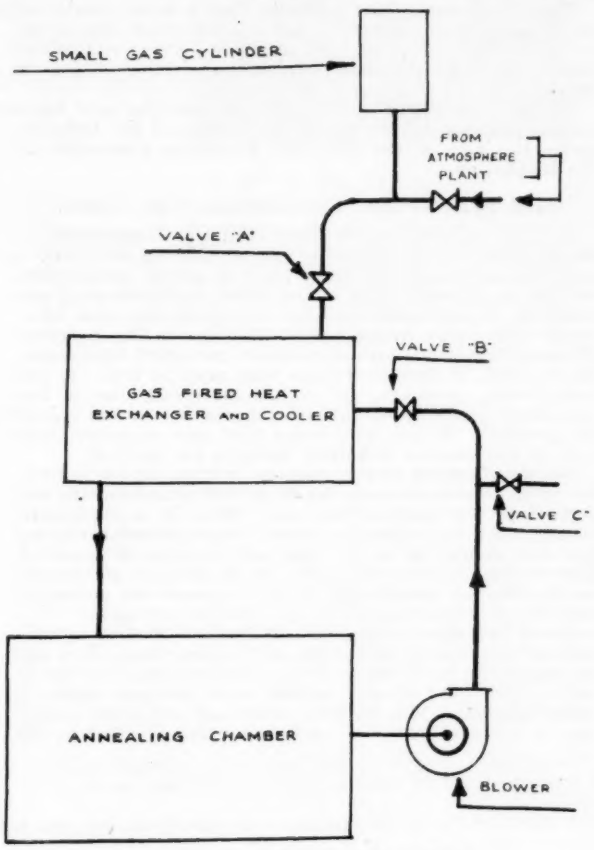


FIGURE 3.—*Bright Annealing Plant.*

now a system purged of air and full of a chemically inert atmosphere which is being circulated at extremely high velocity over the load in the heating chamber, returning through the heat exchanger, and again passing over the load. This is done continuously and the load is rapidly and uniformly heated up by heavy convection currents which at the conclusion of the heating cycle are very little higher in temperature than that reached by the load.

Valve C is of a pressure relief type, and any excess pressure of the atmosphere due to its rise in temperature is avoided.

The cooling cycle is as follows:—The immersion burners in the heat exchanger are of the air gas proportioning type; the gas supply is closed and the air left on, which instantly converts the heating cycle into a cooling cycle; as the hot inert gases are drawn over the load they are passed through the cooler and again over the load. This has the effect of shrinking the volume of gas in the system, but valve A can be arranged to open below certain pressures and the make-up gas to the system can be supplied by a small cylinder, allowing the whole of the annealing and cooling cycle to be operated under a positive pressure.

The design of the annealing chamber and heat exchanger can be of such a type that only a very small amount of sensible heat is lost on cooling, and on this type of plant a

gas consumption of ½ cu.ft. per lb. of net copper annealed should be realized.

A description of a furnace operating on this principle, but with a steam atmosphere, was given in the Industrial Gas Supplement of the "Gas World"[1] of 16th July, 1932, in an article by Mr. J. B. Nealey of the American Gas Association.

It is remarkable that so many manufacturers have come to associate successful bright annealing solely with electric furnaces. When employed on bright annealing the electric furnace must have the same inert atmosphere as any other type of furnace and, given gas at 4d. per therm, no difficulty should be encountered in exploding the myth that only electric furnaces can successfully bright anneal copper. A large number of electric furnaces use bright annealing atmospheres prepared from town gas.

A few individual Companies are working on this problem, and attention should be directed particularly to the work carried out by Dr. H. A. Fells, of the Sheffield Gas Company, in conjunction with British Furnaces, Ltd., from which it seems that the "flight from electricity" has begun.

There is, however, the difficulty that a large number of works doing bright annealing are in areas where the cheapest price for gas is 7d. or more per therm, and where experience of its successful application for this purpose is limited.

Technical problems such as this suggest the need for a central research laboratory for the whole of the Industry under the ægis of the Research Executive Committee of the Institution.

THE STRETFORD INDUSTRIAL GAS LOAD.

It is the practice of the Industrial Gas Department of the Stretford Gas Board (*a*) to call on existing users once a month to ascertain that their plant is giving satisfaction, and (*b*) to interest them in the latest applications of gas firing to the particular product in which they are interested. The latter action means that due to the increased efficiency obtained with up-to-date gas fired equipment, 10 per cent. of that particular load may be lost. It has been found, however, to be advantageous, for it has eliminated competition, cut the consumer's cost and gained his goodwill. It has been found that any consumer dealt with in this manner definitely becomes gas minded.

The development of new business is not a simple matter, for on some occasions one meets with constant rebuffs and it is only by approaching such firms in a diplomatic manner that contact can be made. Once contact is effected the aim should be to see that any equipment installed, however small, is the most efficient of its type, and to rely on the ensuing satisfaction of the consumer to guarantee that gas will have a place in any further extension.

In an industrial area such as Trafford Park it is very easy to concentrate attention on the large consumers and to ignore the small ones. It is, however, much better to have a unit load of, say, 100,000 cu.ft. per hour made up by 20 consumers than by five. Although additional capital cost is incurred in meters and mains, this is offset by the invariably higher price obtained for the gas sold and for the security of the load.

Figure 4 is a graph of the growth of industrial gas sales of the Stretford and District Gas Board from 1926 to 1936.

The decrease in sales during the period 1931 to 1933, a single drop of approximately 108,000,000 cu.ft. per annum, was experienced through one consumer only moving to another area. This was to some extent offset by a continued increase in gas consumption by other consumers but it shows the danger of having the industrial load made up of a few large units.

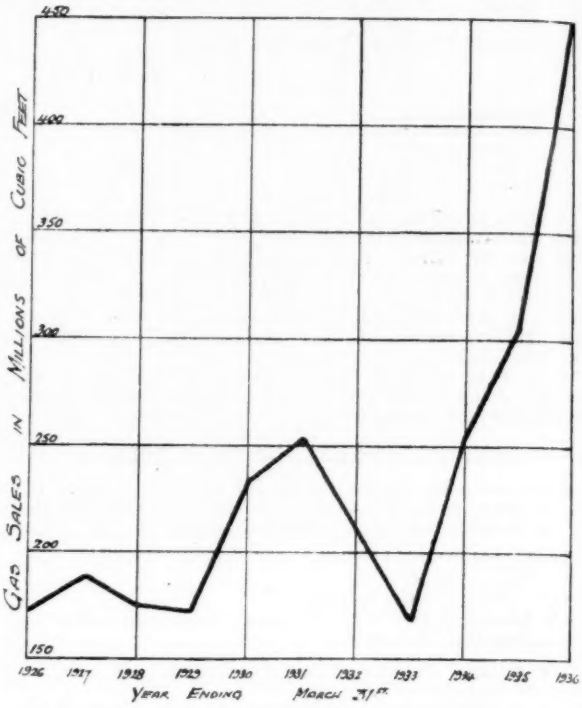


FIGURE 4.—*Gas Sold to Industrial Consumers, 1926 to 1936; Stretford and District Gas Board.*

A special effort is made to call on all potential consumers however small. At this stage careful collaboration must be made with the domestic sales staff as some of these loads would be too low to be immediately allocated as industrial and too high to be called domestic, and might therefore be overlooked by both departments.

The variety of trades using gas in the area served by Stretford and District Gas Board, and the annual consumptions of each, are shown in Table 4 for the years 1928-29 to 1934-35 inclusive.

[1] "Gas Fired Unit Bright Anneals Copper Wire in Atmosphere of Steam," J. B. Nealey, Gas World Industrial Supplement, 16th July, 1932, p. 11.

TABLE 4.—*Analysis of Industrial Gas Sales of the Stretford and District Gas Board.*

Industry.	Year Ending March 1929.	Year Ending March 1930.	Year Ending March 1931.	Year Ending March 1932	Year Ending March 1933.	Year Ending March 1934.	Year Ending March 1935.
1	2	3	4	5	6	7	8
	Therms.	Therms.	Therms.	Therms.	Therms.	Therms.	Therms.
Asbestos Cement Works	3.967	3,832	12,138	10,749	28,222	85,008	114,123
Cafés	3,469	3,260	3,097	2,643	2,295	2,506	2,433
Cable Manufacturers	157,071	159,407	137,728	141,615	138,488	202,121	241,798
Cattle Foodstuffs	4,627	5,521	5,391	4,791	5,630	5,932	6,297
Chemical Soap Manufacturers	37,613	53,067	56 238	90,943	74,127	67,228	47,511
Constructional Engineers	13,767	26,737	49,851	39,080	43,535	44,004	59,496
Electrical Manufacturers	150,511	156,012	173,823	189,335	165,007	204,736	333,994
Furniture Manufacturers	..	..	..	..	2,459	5,190	2,889
Gas Meter Manufacturers	65,395	76,676	48,009	57,229	57,241	121,507	134,094
Motor Car Manufacturers	231,879	485,288	574,482	328,571	2,439	3,303	4,445
General Engineering and Heat Treatment	62,360	63,522	67,603	66,063	58,242	91,900	122,139
General Foodstuffs	42,779	40,956	38,501	47,114	44,960	62,051	77,269
Heating Engineers	..	419	1,284	1,341	1,480	1,458	1,442
Margarine Manufacturers	6,222	6,747	13,083	9,678	26,284	121,744	140,631
Metal Melting	11,409	12,927	17,053	18,087	19,725	26,379	25,751
Oil and Grease Manufacturers	15,185	14,000	13,834	12,007	10,852	12,811	11,356
Printers	4,082	4,305	3,536	3,499	3,245	4,029	3,839
Wire Manufacturers	2,903	3,378	3,289	3,761	3,276	3,378	3,350
Refractory Manufacturers	13,517	15,064	14,237	8,282	11,027	13,000	15,371
Paint Manufacturers	..	..	195	341	470	609	2,088
Warehouses	844	762	761	743	689	931	949
Wood and Straw Manufacturers	1,184	789	756	1,136	11,338	8,239	5.366
Miscellaneous	7,954	5,618	2,584	1,134	1,062	1,036	1,356
Fish and Chip Friers	21,488	27,837	30,678	30,292	27.326	26,816	28,787
Unclassified	..	..	..	..	71,001	152,296	165 452
Total	858,226	1,166,124	1,268,151	1,068,482	840,420	1,268,172	1,525,146

PRODUCTS OBTAINED BY THE Carbonization of Scottish Cannel in Continuous Vertical Retorts

(Communication No. 135)

by

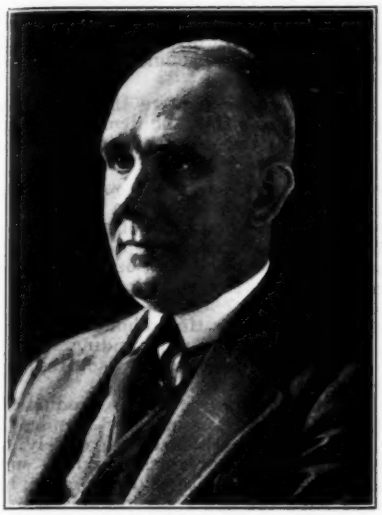
JAMES JAMIESON

(Engineer and Manager, Edinburgh Gas Department)

and

J. G. KING

(Chief Chemist, Fuel Research Station)



JAMES JAMIESON.

Mr. James Jamieson, after completing his practica training, joined his father at Thornliebank, ultimately succeeding him as Manager. Successively, his grandfather, father, and Mr. J. Jamieson managed this concern. He was transferred to the Dalmarnock Station of the Glasgow Corporation on their acquiring this undertaking. Mr. Jamieson has held appointments as Assistant Engineer and Manager to the Dunfermline Gas Commissioners and Greenock Corporation Gas Department, and for twelve years was Assistant Engineer and Manager, until 1933 when he was appointed Engineer and Manager, of the Edinburgh Corporation Gas Department. He is a Past-President of the Scottish Junior Gas Association (Western District), the Waverley Association of Gas Managers, and is Senior Vice-President of the North British Association of Gas Managers.

J. G. KING, B.Sc., Ph.D., A.R.T.C., F.I.C.

Dr. King was educated at the Royal Technical College, Glasgow, graduating in chemistry, in 1912, with distinction. During this year he also obtained the Associateship of the Institute of Chemistry. In 1912 he was appointed Assistant to Prof. T. Gray in the Technical Chemistry Department of the College, and remained there for two academic years. In 1914 he joined the staff of Nobel's Explosives Company at their Ardeer Factory, rising during the next few years to Departmental Superintendent. During 1919 he was appointed Research Chemist at the Fuel Research Station at Greenwich, and, about two years later, became Chief Chemist. He is the author of a large number of scientific papers upon various aspects of fuel technology.

During the last few years experiments have been conducted at the Granton Gas Works, Edinburgh, in co-operation with the Department of Scientific and Industrial Research in connection with the effect of weathering upon a number of Scottish coals. The Director of Fuel Research, Dr. F. S. Sinnatt, C.B., M.B.E., has been personally interested in the investigations owing to their importance in connection with the work of the Fuel Research Physical and Chemical Survey of the National Coal Resources, and has visited Edinburgh to inspect the results and discuss matters with the Engineer. During one visit his attention was called to the fact that high yields of tar had been obtained at Edinburgh by the carbonization of cannel, and that the high yields had been associated with a high yield of gaseous therms and the production of a coke suitable for domestic purposes. It was suggested by the Engineer that a programme of research should be carried out in collaboration with the Fuel Research organization in order to define the exact yields of products obtainable from cannel, and particularly the nature of the tar. The promise of a high yield of tar and of oil associated with the production of coal gas was particularly interesting in view of the National need for motor spirit and oils suitable for the high-speed Diesel engine.

Dr. Sinnatt welcomed the suggestion made by Mr. Jamieson, and further discussions took place after his William Young lecture to the Autumn Meeting of the North British Association of Gas Managers, held at Paisley in 1933. In this lecture Dr. Sinnatt had described the work of the Fuel Research Station on the hydrogenation of low-temperature tar, explaining how much more amenable this was to treatment than the more severely cracked high-temperature tars. Cannel tars were not included in this statement, and it was recalled by the joint author (J. J.) that cannel tars prepared in Woodall-Duckham vertical retorts under the working conditions normal to gas manufacture, gave tars quite different from those produced from bituminous coal. It was thought that cannel tars might be amenable to treatment by hydrogenation, and if this were so then the high yield obtained at Edinburgh made cannel an interesting proposition as regards the production of spirit and oil from coal as an adjunct to the carbonization industry. The proposal was interesting also from the gas making point of view, as the production of a high yield of tar was accompanied by a high yield of gaseous therms, and the coke was of marketable quality. A further discussion was held in London, at which Dr. E. W. Smith, of the Woodall-Duckham Companies was invited to attend as an interested party, not only as representing the builders of the Edinburgh setting of gas retorts but also since he had himself carried out during the war period experiments on the carbonization of cannel. At this meeting, arrangements were made for co-operative researches on gas production to be carried out at Granton by the Works staff, aided by consultation between the authors and Mr. T. C. Finlayson, representing the Woodall-Duckham Companies. Three programmes of work prepared by the joint author (J. G. K.) were considered, and it was arranged that they should be dealt with in the order shown below. It was decided that the investigation of cannel as originally suggested should be the first to be dealt with. The three programmes were:

(1) An investigation of the gas-making qualities of Scottish cannel and of the nature of the products obtained with special reference to the yield of tar and to the production of motor spirit and oil from this tar.

(2) An investigation of the possibility of improving the quality of the vertical retort coke made from Scottish bituminous coals with a view to the production of coke suitable for domestic purposes and particularly for the open grate.

(3) An investigation of the conditions governing the production of benzole or spirit from Scottish coals in vertical gas retorts and the possible modification of these conditions to increase the yield of benzole or spirit.

A start was made with the first research during December, 1934, and the experiments and tests recorded in this Paper have been since carried out, as and when the normal routine of the Granton Gas Works permitted. The routine tests, sampling of coal and coke, &c., were carried out at the Works, while a further examination of the tar and coke was made on bulk samples despatched to the Fuel Research Station. All the data collected were examined critically by the authors and arrangements made in collaboration for methods and conditions of test. Visits were made by Dr. King to Granton at intervals to witness the progress of the work, and throughout two tests he was represented by Mr. H. Bardgett, of the Fuel Research Station. The work was also inspected at more frequent intervals on his behalf by Mr. W. J. Skilling, the Fuel Research Survey Officer for Scotland.

The investigation is an example of the collaboration

which is possible between industrial organizations and the Fuel Research organization of the Department of Scientific and Industrial Research. While the interests of the Edinburgh Gas Department have been kept in mind, the work is of importance to the Scottish coalfields and is of considerable interest from a national standpoint.

The authors desire to express their thanks to the technical assistants of the Edinburgh Corporation Gas Department, particularly Mr. D. Melvin, Mr. T. Scott and Mr. J. G. Scott, and to Mr. W. J. Skilling and Mr. H. Bardgett of the Fuel Research Station. The Edinburgh Corporation Gas Department would like to express grateful acknowledgment of the co-operation of Dr. F. S. Sinnatt, Director of Fuel Research.

ORIGIN AND NATURE OF CANNEL.

A typical cannel differs from bituminous coal in being massive, having a satiny lustre, a marked conchoidal fracture, and in not soiling the hand. Jointing is regular and usually pronounced. Cannels contain from 25 to 45 per cent. fixed carbon and from 45 to 70 per cent. volatile matter, in contrast with from 45 to 75 per cent. fixed carbon and from 20 to 45 per cent. volatile matter for ordinary bituminous coal. It burns readily with a long smoky flame, and usually with a typical crackling noise. The amount of ash is variable and often high, ranging from 3 to as much as 60 per cent. The material is usually non-caking and has to be carbonized in lump form to produce a lump coke.

Lenticles and ribs of cannel commonly accompany seams of coal. When cannel occurs as a separate bed, it seldom extends over an area of more than a few square miles. Thus cannels, occurring as they do in an uncertain, sporadic manner, cannot form a source of material upon which reliance, for any length of time, can be placed. Further, as is particularly stressed by the Geological Survey, owing to the extremely lenticular nature of their occurrence, it is impossible to give, in figures, the actual reserves available in the earth.

The layers of cannel may occur in any part of the seam, and frequently change their position through the thickness of the coal; when the cannel occurs at the top or the bottom of a high-class coal, it is now frequently left in to form the roof or the floor of the workings, a change that has taken place since the days when it was valuable for its use in the enrichment of coal gas for illuminating purposes.

Layers of cannel seldom exceed 2 ft. in thickness, and they frequently pass laterally and almost imperceptibly into bituminous coal, or into shale. Cannel sometimes occurs associated, not with coal, but with black band ironstone.

Prior to the war, a large proportion of the coal used in Scottish gas works was of a cannel or canneloid nature. This was necessary in view of the relatively low gas-making qualities of the bituminous coal available and the high illuminating power standards then in vogue.

About the beginning of this century the standard quality of gas in Scotland was of 26-28 c.p., the gas containing about 9 per cent. of heavy hydrocarbons and having a calorific value of 790 B.Th.U. per cu.ft. With the coming of the incandescent mantle progressive decreases were made and the illuminating power dropped to 14 c.p.

It may be of interest to record that in 1904 the cannel used in Edinburgh for gas-making purposes represented 43·4 per cent. of the total coal carbonized. The quality of the gas was then about 25 c.p. The proportion gradually lessened until in 1909 it was 23·4 per cent., with a quality of 20·5 c.p., and in 1910 the amount used was less than 1 per cent. when the standard was reduced to 17 c.p. The composition of the gas supplied in 1906 was:—

Carbon dioxide	0·2
Unsaturated hydrocarbons	9·2
Oxygen	0·2
Carbon monoxide	10·8
Methane	37·1
Hydrogen	36·6
Nitrogen	5·9

The effect of the large amount of cannel is reflected in the high hydrocarbon content, although this may be partly due to the use of a lower carbonizing temperature.

The downward tendency in the use of cannel was also assisted by the demand for coke for industrial purposes, many of the cokes from cannel being unsuited for sale; in fact it was sometimes a condition of purchase of the more shaly cannels that the suppliers should remove the resultant solid residue free of charge.

Again, cannel became more expensive than bituminous coal and the overall result was that the demand gradually ceased and, except in one or two instances, it is practically unworked to-day.

Certain of these cannels possess qualities which still make them useful for gas-making purposes within certain limitations. They give a higher thermal yield of gas, a large tar production and produce a coke which, while easily distinguishable from ordinary gas coke, still possesses comparatively free-burning properties and contains not more than a reasonable percentage of ash. Of the total coal carbonized in Edinburgh at the present time about 2·1 per cent. is cannel of this nature, and, notwithstanding its higher initial cost, the cost per therm of manufactured gas is below the average of that from other coals.

No special effort is made to segregate the products from the cannel; in fact, the cannel is usually blended with bituminous coal rather than carbonized separately. The tar produced from this cannel is much lower in specific gravity and possesses certain definite characteristics; but it blends satisfactorily with the other tar produced, and in this small proportion has no marked effect. No difficulties are experienced in either handling or separation of the mixed tars and no stratification or after-separation has been observed.

Within recent years it has become increasingly evident that every possible source of " home " produced oils must be fully exploited or valued. If such a source can be commercially exploited and if, at the same time, the production of the raw material provides employment and re-opens seams of coal which have been closed or left unworked for want of a market, no effort should be spared in carrying out the fullest investigation possible. The more recent demand for tars and oils amenable to hydrogenation also holds out hopes of a ready market for the light tar produced.

The cannel used in this investigation was obtained from the Newbattle Colliery, Midlothian. At this colliery two seams are mined, the Parrot and the Great seam. The Parrot seam, a bright coal suitable for household purposes, is from 3 to 4 ft. thick, and contains a band or rib of cannel which varies in thickness from 6 to 11 in. between Arniston and Newbattle collieries. To the north the cannel band thins out, and at the old Cowden pit, 2¾ miles north, is said to be only 1 in. thick. The cannel band is of good and fairly constant quality.

A band of cannel of poorer quality is also associated with the Great seam. This material shows in the Gray-King assay only about 38 gal. of tar per ton in comparison with 68 gal. from the Parrot cannel. At Newbattle the band is about 7 in. thick, but at Niddrie it varies from 14 to 80 in. and is much richer, assaying about 50 gal. of tar per ton. In the East Lothian field the band does not exist.

These observations emphasize the above statement regarding the variable occurrence of cannel and illustrate the difficulty of assessing reserves even approximately.

The proximate analysis of the average sample used in each test is shown in Table 1.

The variations in ash content are not large, from 3·9 to 5·9 per cent., but those of ash-free, dry volatile matter, from 44·1 to 52·5 on Tests G and H are significant of real differences which were later found to be reflected in the behaviour of the coal on carbonization.

TABLE 1.—*Analyses of Cannel Samples.*

Test	A	B	C	D	E	F	G	H
1	2	3	4	5	6	7	8	9
Moisture . . per cent.	4·6	4·8	2·6	2·3	2·4	3·0	5·1	2·6
Volatile matter. ,,	43·6	42·3	41·9	44·1	45·8	46·3	39·3	49·1
Fixed carbon . ,,	45·9	47·2	50·0	48·9	47·2	46·3	49·8	44·4
Ash . . . . ,,	5·9	5·7	5·5	4·7	4·6	4·4	5·8	3·9
Volatile matter in ash-free dry cannel	48·7	47·3	45·6	47·4	49·2	50·0	44·1	52·5

CARBONIZATION PLANT.

At Granton one bed of four retorts has been separated from an installation of eleven beds in order to make use of it as a test bench for testing coals and for experimental purposes generally. The bed is separated as regards both

control, collection, and measurement of products, but is used as part of the normal system when not under test.

The bench was started up in 1926, so that the test bench is not now in its best condition for test purposes. The retorts are Woodall-Duckham continuous verticals of 76 in. major axis.

The retorts were built in 1925 and worked continuously from February, 1926, to July, 1931, when the whole bench was let down for general repair and rebuilding of the upper portion, the retorts in the test bed being rebuilt down to approximately 11 ft. 6 in. from the top, the remainder being repaired and repointed. The bench was again brought into use in August, 1934, and is still at work. Spraying and pointing are carried out during each scurfing period as required, and the retorts kept in as good working condition as is possible.

Each bed of four retorts has a separate built-in step-grate producer. The retorts are heated in a downward direction, and the waste gases pass through recuperators and waste-heat boilers.

The coal bunkers on the test bed are specially divided in order to facilitate accurate measurement of the coal used and are fitted with covers to prevent the access of other than test coal. The coke bunker supplying the test-bed producer is similarly treated.

DETAILS OF TESTS.

The experimental work was started during December, 1934, by conducting a preliminary test under normal carbonizing conditions during which the various arrangements specially made for test purposes were tried out and any necessary adjustments were made. Since then a series of tests has been carried out under different conditions but with particular reference to the requirements of town gas in the Edinburgh district. The tests reported in this Paper are the following:

Test A.—The temperature of carbonization was reduced from normal conditions by about 200° C. in order to determine whether this would affect the yield and/or nature of the tar and whether the combustibility of the coke would be so far increased as to make it more suitable as a fuel for the open grate. The steam used was approximately 20 per cent. by weight of the coal.

Test B.—The temperature of carbonization was raised to the normal level of 1,400° C. at the top of the retorts and 1,200° C. at the check tile. The throughput of coal aimed at was 8-9 tons per retort per day.

Tests C, D and E.—The same conditions were maintained as for test B with the exception that the steam percentage was increased to 30 in order to produce a gas of a calorific value of approximately 480 B.Th.U. per cu.ft.

Test F.—The setting of retorts used for experimental purposes was beginning to show signs of leakage towards the end of 1935. It was therefore closed down at a convenient date and the lower section repaired as well as possible. Test F was carried out under the same conditions as tests C, D and E but after the pointing had been completed.

Test G.—This test was carried out under approximately the same conditions as tests C, D and E but it was arranged that as high a rate of production of gas should be obtained as possible at a calorific value of 480 B.Th.U. per cu.ft.

Test H.—This test was carried out under normal conditions of temperature but using a percentage of steam of 14, this being considered to be the lowest practical input. It was intended that this reduction of steam would indicate whether steam was the important factor preserving a high yield of tar. Since the calorific value of the gas produced was 514 B.Th.U. per cu.ft. this test also served to assess the possibility of recovering motor spirit from the gas and still producing a town gas of 480 B.Th.U. per cu.ft.

The main details of the results of these tests are set out in Table 2 and the subsidiary details in the tables dealing with the individual products.

No difficulties whatever were encountered in the actual carbonization of the cannel. It was necessary however to arrange for the circulation of hot liquor in the foul main in order to avoid the deposition of wax from the tar.

TABLE 2.—*Carbonization of Newbattle Cannel in Woodall-Duckham Vertical Retorts.*

RESULTS EXPRESSED PER TON OF CANNEL AS CHARGED.

Test Number	A	B	C	D	E	F	G	H
1	2	3	4	5	6	7	8	9
Temperatures of chambers . . ° C.	1,179	1,388	1,374	1,389	1,389	1,358	1,394	1,375
Temperatures of check tile . . ° C.	901	1,195	1,179	1,176	1,192	1,195	1,107	1,219
Steam . . . . . tons	20·5	22·2	29·3	31·5	31·7	28 8	25·1	13·4
,, ... per cent. of cannel	19·4	20·7	27·5	30·7	30 8	28·4	24·9	13·7
Scrubber water . . . . . tons	..	..	6 35	7·55	5 76	7·06	2·70	5·66
,, ,, ... gal. per ton cannel	..	..	13·3	16·5	12·5	15·6	6·0	13·0
CANNEL—								
Total carbonized . . . . . tons	105·67	107·35	106·65	102·55	102·85	101 28	100·90	97·53
Amount per retort per day . . ,,	8·81	8·95	8·89	8·55	8·57	8·44	8·41	8·13
Moisture . . . . . per cent.	4·6	4 8	2·6	2·3	2·4	3·0	5·1	2·6
Ash . . . . . ,,	5·9	5·7	5·5	4 7	4·6	4·4	5·8	3·9
COKE (DRY)—								
Total produced . . . . . tons	48·43	..	46·39	42·94	42·04	40·25	47·62	43·56
Yield per ton of cannel . . . cwt.	9·16	..	8·70	8·38	8·18	7·95	9·44	8·93
Volatile matter . . . . . per cent.	4 9	3 1	4·1	3·8	2·8	3·2	4·1	1·8
Ash . . . . . ,,	8·9	9·4	10·1	9·4	9·1	9·4	9·4	8·6
Graded > 1 inch. . . . . ,,	76·4	74·2	71·7	56·2	58·9	57·9	73·3	58·0
Graded < 1 inch. . . . . ,,	23·6	25·8	28·3	43·8	41·1	42·1	26·7	42·0
GAS—								
Total volume . . . . . cu.ft.	1,849,500	2,450,400	2,652,900	2,614,600	2,397,200	2,406,700	2,673,500	1,840,800
Yield per ton of cannel . . . ,,	17,500	22,830	24,880	25,500	23,310	23,760	26,500	18,880
Yield per ton of cannel . . . therms	98·4	113·2	117·2	122·7	115·6	115·7	127·2	97·0
Yield per retort per day . . ,,	866	1,013	1,041	1,048	990	977	1,069	788
Specific gravity	0·543	0·524	0·515	0·533	0·525	0·520	0·513	0·510
Calorific value . . . B.Th.U. per cu.ft.	562	496	471	481	496	487	480	514
H_2S in crude gas . . gr. per 100 cu.ft.	530	349	687	570	911	1,206	711	1,058
Spirit . . . . . gal. per ton	4·30	..	4·65	..	..	5·17	4·52	..
TAR (DRY)—								
Total produced . . . . . gal.	4,368	4,010	4,539	4,727	4,972	5,470	4,185	4,909
Yield per ton of cannel . . . ,,	41·3	37·4	42·6	46·1	48·3	54·0	41·5	50·3
Specific gravity	0·997	1·001	1·011	1·006	0·996	0·989	0·998	0·987
LIQUOR—								
Total produced . . . . . gal.	2,407	2,199	4,522	3,801	3,693	3,690	3,788	2,552
Yield per ton of cannel . . . ,,	..	..	42·4	37·1	35·9	36·4	37·5	26·2
Specific gravity	1·023	1·017	1·018	1·018	1·016	1·016	1·016	1·014
Ammonia . . . . . per cent.	1·78	1·37	1·41	1·38	1·36	1·33	1·34	1·35
FUEL USED—								
Coke per ton of cannel . . . cwt.	..	2·66	2·42	2·30	2·43	2·72	2·40	2·35

Similarly the special precautions detailed above were necessary to arrange for efficient separation of the tar and liquor. In this series of experiments the methods of separation were fairly satisfactory but were always rendered more difficult by the discontinuous nature of the tests. A considerable interval of time was necessary, each time the plant was started up, to work the tar separation system to a satisfactory state. In continuous work there is no doubt but that the process of separation would be appreciably easier.

EXPERIMENTAL RESULTS.

The Gasification of Cannel in Comparison with Scottish Gas Coals.

The proportion of cannel normally used at Granton is small (2·1 per cent.) and no difficulties are experienced or special precautions required during carbonization. It is blended with certain of the poorer bituminous coals, with the addition of a proportion of caking coal or caking smalls, so that the quality of the coke does not suffer. If the proportion of cannel is increased the output of the plant improves noticeably, and additional steam has to be introduced to keep the calorific value of the gas constant.

Gas Yield.

The various tests have shown that the highest throughput which can be maintained while holding the temperatures normal to carbonization in a 76 in. Woodall-Duckham retort is about nine tons per retort per day. With this throughput, and steaming to the extent of 30 per cent., a gas of about 475-480 B.Th.U. per cu.ft. calorific value is obtained which is suitable for the requirements of the Edinburgh district.

The yield of gas is approximately 120 therms per ton of cannel as charged, or about 130 therms per ton of dry ash-free material, a yield which is much in excess of that obtained from Scottish bituminous coals. Comparisons with other coals should strictly be made under conditions which yield a gas of the same calorific value. In Table 3 a comparison is made of the yields obtained from a Yorkshire gas coal and a Scottish bituminous coal, both under conditions which yield a gas of a calorific value of about 480 B.Th.U. per cu.ft.

Comparisons of the yields shown in Table 3 indicate that the gas yield from cannel is higher than that from a first quality Yorkshire gas coal and much higher than that of a Lanarkshire gas coal, under conditions in which the calorific value of the gas is the same in each case. The increases are 24·7 and 58·3 therms per ton on a dry ash-free basis. Part of the thermal increase is however due to the heavier steaming which is possible with cannel, a gas of 481 B.Th.U. being obtained with 30·7 per cent. of steam as against 12·4 per cent. of steam in the case of the Yorkshire coal and 13·3 per cent. of steam in the case of the Lanarkshire coal. Comparisons of gas yield at the same percentage of steam are also made in Table 3, where it is seen that the calorific values of the gases from the bituminous coals are reduced to 432 and 436 respectively. Under these conditions the cannel still produced a higher yield of gas, 9·9 therms above the yield of gas from the Yorkshire coal and 37·5 therms above the Lanarkshire coal, on a basis of dry ash-free coal. It is also of the greatest importance that the higher yield of gas is achieved with cannel while maintaining a high level of calorific value. The high proportion of carbon monoxide in the cannel gas is apparently due to the higher reactivity to steam of the cannel coke.

Tests D, B, and H show the effect upon the gas yield of varying the percentage of steam from 30·7 to 13·7, the yields of gas increasing with increased steaming. The effect of the steam is somewhat obscured by the variations in the cannel, but the results fall on relatively smooth curves for both volume and calorific value. Unfortunately, the lack of information regarding the yield of gas in the absence of steam prevents the calculation of the efficiency of conversion of the steam.

The calorific value of the gas under normal conditions in tests D, F, and G is approximately 480 B.Th.U. per cu.ft., the value required for the Edinburgh supply, so that if cannel were to be used to any extent in Edinburgh, there would be no difficulty in meeting the requirements of the declared calorific value. In test H, where 13·7 per cent. steam was used instead of 30 per cent., the calorific value increased to 514 B.Th.U. and the gas yield was reduced to 97 therms. It is interesting to consider that if the gas was stripped for the recovery of motor spirit, the stripped gas would have again a calorific value of approximately 480 B.Th.U. per cu.ft. In Test C, the gas yield was reduced by stripping from 117·2 therms to 108·4 therms, and crude spirit was recovered equivalent to 4·65 gal. per ton of cannel.

The requirements of Edinburgh town gas could therefore be met either by steaming at 30 per cent. and not recovering spirit, or by steaming to 13-14 per cent. and recovering spirit. The difference in these two alternatives, *e.g.*, Tests D and H, is represented by a loss of gaseous therms of 32·1 per ton and a gain of 6·1 therms, or 4·1 gal. of refined motor spirit. Alternatively, the full yield could be realized if enrichment by carburetted water-gas were used in the usual way to overcome the impoverishment. Considerations of cost would decide whether complete or partial stripping of the gas would be an economic proposition.

Recovery of Benzole or Spirit from Gas.

The experimental retort bench did not embody a gas stripping plant, and special arrangements had to be made to treat a sample of the gas in certain tests in order to discover the potential yield and nature of the spirit which could be recovered. Recovery experiments were made in tests A, C, F, and G, when it was found that it was possible to recover from 4·3 to 5·2 gal. of crude spirit per ton of cannel carbonized. The removal of this spirit reduced the calorific value of the gas by about 38 B.Th.U. and the thermal yield by 8·8 therms, so that if gas stripping were resorted to in practice to obtain the full yield of spirit it would not be possible to use more than about 15 per cent. of steam (as Test H) if a final gas calorific value of 480 B.Th.U. were to be assured. Partial stripping would, of course, allow of the use of higher rates of steaming.

The spirit recovered was not a benzole and is more comparable with the type of spirit recovered by the scrubbing of gas from low-temperature carbonization plant. One sample was refined and analysed to give the results shown in Table 4. These results show that the spirit contains only 28 per cent. of aromatic hydrocarbons and that it is highly unsaturated. Despite the presence of these unsaturated hydrocarbons, it is readily refined to a stable water-clear spirit by washing with 20 per cent. caustic soda and 10 per cent. sulphuric acid solution followed by steam

TABLE 3.—*Comparison of Gas Yields from Cannel and Bituminous Coal.*

—	Cannel, Test D.	* "Mitchell Main," Parkgate.		* Main and Ell, Lanarkshire.	
1	2	3	4	5	6
COAL—					
Moisture . . . per cent.	2·3	1·1	1·3	10·9	10·5
Ash . . . ,,	4·7	9·6	7·9	6·1	6·3
STEAM . . . ,,	30·7	12·44	30·0	13·3	32·7
GAS—					
Yield per ton . . . cu.ft.	25,500	20,060	25,610	12,670	17,814
,, ,, . . . therms	122·7	95·7	110·8	61·1	77·7
,, ,, , dry, ash-free coal . . . ,,	131·9	107·2	122·0	73·6	93·4
Cal. value . . . B.Th.U. per cu.ft.	481	477	432	482	436
Sp. gr. (air = 1) . . .	0·533	0·428	0·446	0·46	0·49

* Report of Fuel Research Board, 1920-21 (First Section).

TABLE 4.—*Analysis of Refined Spirit.*

Yield of refined spirit per ton cannel . . . . . 3·8 to 4·6 gal.

Specific gravity . . . . . 0·745

Distillation range	°C.	Per Cent.	Per Cent.	°C.
	To 75	0·5	5	82·6
	,, 100	38·0	10	87·2
	,, 125	76·5	20	92·2
	,, 150	94·0	50	106·3
	,, 169·3	99·5	90	140·8

Unsaturated hydrocarbons . . .	40 per cent.
Aromatic ,, . . .	28 ,,
Saturated ,, . . .	32 ,,
Octane number	70

distillation. The yield of refined spirit amounts to 88 per cent. of crude spirit.

Owing to the high percentage of unsaturated hydrocarbons, the spirit has a satisfactory octane number of 70, which compares with the 72 normal to a Grade I petroleum spirit.

In view of its low percentage of aromatic hydrocarbons it is not likely that this spirit could be sold through the medium of the National Benzole Association. It is suggested rather that it should be refined in the gas works and sold in a local market either as blending stock or as a special spirit retailed under a trade name. To this particular spirit could also be added the small proportion (1·0 gal. per ton), which is obtained by distillation of the tar.

The unsaturated nature of the spirit also makes it a promising raw material for the manufacture of lubricating oil by condensation with aluminium chloride. It has been shown that a gas spirit containing about 32 per cent. of unsaturated hydrocarbons will yield 8 per cent. of its weight of viscous oil, which can be separated by vacuum distillation into grades of lubricating oil. This treatment with aluminium chloride can be made to take the place of refining, and although quite stable oils have not yet been produced commercially, the process shows considerable promise.

Total Volatile Therms.

Table 5 shows the total yield of volatile therms in the form of gas and tar per ton of cannel as carbonized in each test. The yield is over 200 therms at 30 per cent. steam, as compared with the much lower yields of 135 and 114 for two bituminous coals carbonized with approximately the same amount of steam.

The increase in volatile therms from the cannel with increasing proportion of added steam is masked by the variations in the cannel.

TABLE 5.—*Yield of Volatile Therms.*

Test	A	B	C	D	E	F	G	H	"Mitchell Main."	"Main & Eil"
1	2	3	4	5	6	7	8	9	10	11
Steam . . per cent.	19·4	20·7	27·5	30·7	30·8	28·4	24·9	13·7	30·0	32·7
Gas. . . therms	98·4	113·2	117·2	122·7	115·6	115·7	127·2	97·0	110·8	77·7
Tar . . ,,	72·5	65·9	75·8	81·6	84·7	94·0	72·9	87·4	24·0	36·2
Volatile therms	170·9	179·1	193·0	204·3	200·3	209·7	200·1	184·4	134·8	113·9

Coke.

Cannel coke is grey in colour and has a dull, hard appearance, which at first sight is rather unprepossessing in comparison with normal gas coke. It is, however, hard and strong, and resists transport with the minimum of breakage. There is no reason, therefore, why its dull appearance should be a disadvantage for sale purposes provided its combustibility is satisfactory.

The size of the coke depends mainly upon the size of the cannel charged, since there is no agglomeration in the retort. The larger pieces of cannel do split during carbonization, but the splitting seems to form smaller pieces of coke rather than breeze. The overall effect, therefore, is that a high proportion of the coke falls between the sizes of 1 and 2 in. This behaviour is rather unusual in coal treatment and seems to be peculiar to hard coals such as durain and cannels. The natural shrinkage of the cannel on coking, which is about 20 per cent. by volume, accounts fully for the slight increase in breeze passing a ¾ in. screen. It may be said, therefore, that breeze is not formed in the retort.

Since the proportion of volatile matter in cannel is high, the yield of coke must necessarily be low. A comparison with a Yorkshire coal is given in Table 6. At 30 per cent.

TABLE 6.—*Yield of Coke.*

—	Cannel.		Yorkshire Parkgate.
	Test H.	Test D.	
1	2	3	4
Steam . . . . . per cent.	13·7	30·7	30
Dry coke . . . . cwt.	8·93	8·38	12·8

steam the yield is only 8·4 cwt. in comparison with 12·8 cwt. from a typical gas coal. In addition to this lower yield, and due to the grading of the cannel charged, the proportion of coke saleable as lump coke is also less since the percentage of breeze is as high as 20 per cent. The lump coke is a fairly regular size, mainly 1-2 in., and requires no further crushing before separation into commercial grades. A further reason for the low yield of coke is, of course, the high percentage of steam used. The coke yields above for tests H and D give a measure of this reduction. At 30·7 per cent. steam the yield is 8·38 cwt., and at 13·7 per cent. steam 8·93 cwt. This indicates that the gross yield in the absence of steam would be about 10·5 cwt.

The value of the coke for domestic purposes has been tested by selling it in the district and also by carrying out grate tests at the Fuel Research Station. As far as sales are concerned, the results have been satisfactory, the coke having proved to be suitable for use in domestic stoves and also in special coke grates in which combustion is aided by thermal insulation and by the provision of strong draught.

The results of the tests are given in Table 7. Approximately the same amount of heat was required for ignition

TABLE 7.—*Combustibility Tests on Cannel Cokes.*

Sample.	Heat Required for Ignition.	Time Taken to Reach an "Intense" Fire.	Maximum Rate of Radiation.	Duration of "Intense" Fire.	Amount of Charge Consumed.
	B.Th.U.	Minutes.	Heat Units per Minute	Minutes.	Per Cent.
Standard coke .	1,120	56	1·32	80	76
1	2	3	4	5	6
Cannel coke A .	1,900	71	1·23	68	72
,, ,, B .	2,070	80	1·23	68	72
,, ,, G .	1,850	67	1·11	55	75
,, ,, H .	1,900	66	1·20	51	70

in spite of the fact that the sample from test A contained a higher proportion of volatile matter. In each case the rate of burning was rather slow. The time required to reach a condition of "intense" fire being on the average, 15 minutes behind the standard of comparison. Otherwise the cokes produced satisfactory radiation curves.

During combustion it was noticed that the surface of the pieces of fuel became coated with white ash which gave the fire a rather unprepossessing appearance. The cokes continued to glow under the coating of white ash for a particularly long time but it is almost certain that the ash reduced the amount of radiation given off by the fire. This white ash constitutes therefore a serious difficulty in the application of the coke for the open grate, a difficulty which is disappointing in view of the fact that the coke satisfies all the other requirements.

Cannel Coke as a Producer Fuel.

An immediate improvement in the producer conditions was noticed to follow the introduction of cannel coke.

Clinker was practically absent and the ashes were removed in a non-coherent condition.

On the reintroduction of unscreened coke from bituminous coal the fire reverted to its normal condition, the temperature showed a tendency to fall, particularly at the bottom, and clinker formation was evident.

Cannel Coke in a Water Gas Plant.

A special test to determine the behaviour of the coke was carried out at Granton in a carburetted water gas plant employing the back-run process. The generator was equipped with automatic time control gear and self-clinkering grate. Screened coke from test H was used and a C.W.G. of 500 B.Th.U. per cu.ft. was aimed at. Owing to the rather limited amount of coke available the test run was of short duration and the results possibly do not represent the best that can be done with cannel.

It was found that the amount of "carbon" consumed per unit of C.W.G. made was 12·2 per cent. more and the output of gas was 16·1 per cent. less than in the case of coke from bituminous coal.

This greater consumption of "fixed carbon" is offset to

some extent by the 3 per cent. lower consumption of oil. In view of the short period of this test these results may be considered satisfactory and it may be concluded that coke from this particular cannel is a suitable fuel for the production of water gas.

TABLE 8.—*Cannel Coke in Water Gas Plant, Daily Performance.*

	Cannel Coke.	Guarantee Test Coke from Bituminous Coal.	
1	2	3	4
		(i)	(ii) *
Gas made at 30 in. and 60° F. satd.—			
Thousands of cu.ft.	2,130	2,540	2,284
No. of gas-making runs	570	..	..
Gas . . . . . B.Th.U. per cu.ft.	500·5	502·2	500
Oil . . . . . gal. per 1,000 cu.ft. C.W.G.	1·94	2·00	2·00
Coke (dry) used . . . lb. per 1,000 cu.ft. C.W.G.	29·2	27·1	35·1
Net "fixed carbon" consumed in generator . lb. per 1,000 cu.ft. C.W.G	25·7	22·9	26·5
Carbon in fliers . . . lb. per 1,000 cu.ft C.W.G	0·26	0·32	..
Carbon in clinker . . lb. per 1,000 cu ft. C.W.G.	0·35	0·28	..
Steam produced—			
Annular boiler at 30 lb. per sq. in.	62·5	54·9	..
Waste heat ,, 107 ,, ,,			

* This column gives the yields which would be expected from coke of the same grading but made from bituminous coal.

TAR.

It has already been stated that cannel contains potentially a much higher proportion of tar than bituminous coal. The Gray-King assay has shown that under the favourable conditions of the laboratory, the yield may be as high as 70 gal. per ton of dry ash-free cannel. The proportion of this which can be recovered in practice depends upon the nature of the carbonizing conditions used. The tar is particularly sensitive to thermal cracking and, even if the conditions are those of low-temperature carbonization, a low percentage yield may be obtained if the extent of the cracking surface is comparatively large or the time of contact of the vapours with it long. For example, in a retort of the Beilby type, heated externally to 600° C., cannel will give a tar yield amounting to only 60 per cent. of that obtainable in the assay.

It is apparent, therefore, that a high tar yield is obtainable from cannel only under conditions which do not promote cracking, *i.e.*, either a low temperature or a short time of contact of the vapours with hot surfaces. The relative importance of these two factors depends upon other conditions. Now in the present series of experiments a high yield of tar has been obtained and it must be concluded that the following is the reason. The cannel being a sized material, and only weakly caking, gives, in a vertical retort, an open charge which offers a free upward passage for the gas and vapours. Normally, in a vertical retort the charge cokes and the gases are forced outwards to the hot walls of the retort where the cracking is more severe. The yield of tar can be varied in the Gray-King high-temperature assay from 20·7 to 42·8 gal. per ton of cannel by altering the temperature of the cracking surface from 800° to 650° C.

It might be thought that the high proportion of steam used in the present tests was a contributory factor to the production of a high yield of tar, in that it would not only reduce the time of contact of the gases with the hot walls but would also afford some physical protection. Test H, carried out at a lower percentage of steam, has however shown that the effect, if any, is only secondary to that of size of coal.

Finally, therefore, it may be concluded that the conditions obtaining in a vertical gas retort are such that cracking is so much reduced when a sized, non-caking material is carbonized that a high yield of tar can be obtained from a coal such as cannel even when the high temperatures normal to gas manufacture are being used. The nature of the tar may, of course, be influenced by the high temperature, but this influence is not large. For this reason the complete examination of the tar has been limited to one tar, representative of that obtained under normal conditions of high output, which would be obtained if the cannel were carbonized to produce Edinburgh town gas of a calorific value of 480 B.Th.U. The tar examined was that produced in Test B, when using 20 per cent. of steam and carbonizing at a throughput of 9 tons per retort per day.

The tar was analyzed by an empirical method devised for the rapid examination of tar in the laboratory. The results are shown in Table 9 in comparison with the tar produced in Test A when the temperature of carbonization was lower, a tar produced during the carbonization of Yorkshire coal in Fuel Research low-temperature retorts, and a low-temperature cannel tar.

The cannel tars are of much lower specific gravity (1·00) than the low-temperature bituminous coal tar (1·06), but evidence of cracking is found in that they are still appreciably denser than the cannel tar produced at a temperature of 600° C. (0·91).

The elementary composition of the tars is interesting in that the atomic ratio of disposable hydrogen to carbon is 1·23 in Test A, 1·20 in Test B where the temperature was 200° C. higher, and as high as 1·45 in the low-temperature cannel tar. The ratio in the case of the low-temperature coal tar is quite different, 0·97, indicative of the different nature of bituminous coal tar. These high hydrogen carbon ratios show that cannel tars should be amenable to hydrogenation. The high ratio is reflected in a high calorific value of 17,600 B.Th.U. per lb.

The residue obtained by the distillation of the cannel tars to 360° C. was a soft pitch. The distillation of the tar from Test B to 400° C. gave a pitch having a twist point of 56° C., reduced the percentage of pitch from 54·2 to 33·4, and correspondingly increased the amount of distillable oil from 44·8 to 65·6 per cent. That the lower figure is nearer to the true pitch content is shown by the fact that only 21 per cent. of the crude cannel tar is insoluble in petroleum ether (b.p. 40°-60°), as against about 25 per cent. in the case of Fuel Research low-temperature tar.

Crude cannel tar is a dark brown, semi-solid material of about the same density as water. For this reason difficulties were encountered in the separation of tar and liquor. The semi-solid nature of the tar is due to the presence of a fairly high proportion of paraffin wax. In Test B, the proportion of wax in the tar was 5·8 per cent. by weight, the crude wax being a dark brown material having a melting point of 51°-57° C. Re-crystallization of this wax from acetone yielded a pale yellow material having a melting point of 54°-57° C. It is possible that this wax might, with further purification and separation, have some industrial application.

TABLE 9.—*Analysis of Cannel Tars.*

Test	A	B	Fuel Research Low Temperature Tar	Low-Temperature Cannel Tar.
1	2	3	4	5
Temperature of carbonization, °C.	1,180-900	1,374-1,180	620	620
Specific gravity at 15° C.	0·997	1·001	1·056	0·910
Free carbon . . . . per cent.	0·35	0·35	1·5	0·13
DISTILLATION (by weight)—				
Oil to 360° . . . . per cent.	47·2	44·8	57·8	67·8
Residue (soft pitch) . ,,	52·3	54·2	41·7	31·7
Loss . . . . . ,,	0·5	1·0	0·5	0·5
ANALYSIS OF OIL TO 360° C.—				
Tar acids	7·3	9·1	19·3	4·2
Tar bases	2·8	2·3	1·2	0·5
Neutral oil	37·1	33·4	37·3	63·1
Total	47·2	44·8	57·8	67·8
DISTILLATION OF NEUTRAL OIL—				
Up to 170° C.	1·2	0·7	3·6	14·0
170°–230° C.	7·1	6·5	8·2	14·3
230°–270° C.	7·2	7·5	7·7	10·4
270°–360° C.	16·2	13·6	14·3	19·2
Residue	5·4	5·1	3·5	5·2
Total	37·1	33·4	37·3	63·1
ANALYSIS OF TAR—				
Carbon . . . per cent.	83·9	83·5	85·2	85·5
Hydrogen . . . . ,,	9·5	9·3	7·8	10·8
Nitrogen . . . . ,,	0·7	0·6	0·6	0·5
Sulphur . . . . ,,	0·6	0·6	0·7	0·6
Oxygen (by difference) ,,	5·3	6·0	5·7	2·6
Disposable hydrogen . per cent.	8·6	8·5	6·9	10·3
Atomic ratio (H/C).	1·23	1·22	0·97	1·45

Tar oils from cannel tars are unsuitable for use as fuel oils for the high-speed diesel engine.

Tests demonstrate that the viscous fractions from cannel tar are unsuitable for use as lubricating oils. Cannel tar might, however, form a suitable raw material for cracking and subsequent condensation and would appear to justify further experiments.

Hydrogenation-Cracking of the Tars.

Owing to the interest now attaching to the hydrogenation of tars and to the promise indicated by the high hydrogen/

carbon ratios of the tars, special experiments were carried out at the Fuel Research Station upon the three tars shown in Table 9. In the experimental data which follows are included the results of examination of a special tar which was produced by the carbonization of cannel at a temperature not exceeding 600° C.

The results of the experiments are shown in Table 10 in comparison with a Fuel Research low-temperature coal tar[1] and a cannel tar produced, at the Fuel Research Station, at a temperature not exceeding 600° C.

Each experiment was continued for about 160 hours in order to observe the rates of deterioration of the catalyst. During the first day when the catalyst was fresh, the amount of spirit (b.p. 200° C.) produced was 29·4 per cent. for tar A and 28·6 per cent. for tar B. This was considerably less than that produced from the low-temperature bituminous coal tar or the low-temperature cannel tar.

The results were satisfactory in that the catalyst showed only a slow rate of deterioration. The rate of deterioration can be measured either by observing the rate of increase of specific gravity of the product or rate of decrease of the spirit yield, since the relationship between these is linear. The rates of decrease of specific gravity in the case of tars A and B were only 0·003 and 0·004 per

TABLE 10.—*The Hydrogenation-Cracking of Cannel Tars.*

PERCENTAGES BY WEIGHT.

Test	A		B		Fuel Research Low-Temperature Tar.		Cannel Low-Temperature Tar.
1	2		3		4		5
Specific gravity of crude tar	0·997		1·001		1·056		0·910
Specific gravity of crude product, first day	0·852		0·857		0·867		0·801
Spirit to 200° C, wt. per cent. of tar	29·4		28·6		45·4		43·8
Oil over 200° C., wt. per cent. of tar	61·0		61·4		44·0		46·2
Rate of deterioration of catalyst—							
Increase of specific gravity of product per day	0·003		0·004		0·006		0·001
Decrease of spirit per day	0·8		1·0		1·6		0·4
	Wt. per Cent.	Cu.Ft. per Gal.	Wt. per Cent.	Cu.Ft. per Gal.	Wt. per Cent.	Cu Ft. per Gal.	
Hydrogen consumed—							
Second day	4·69	84	4·06	73	5·5	106	..
Fifth day	4·18	75	3·76	68	4·7	91	..
Hydrogen retained in oil—							
Second day	2·44	..	1·75	..	3·0	..	..
Fifth day	1·93	..	1·33	..	2·3	..	..

day in comparison with the higher rate of 0·006 for low-temperature tar. The rate for the low-temperature cannel tar was only 0·001. This is a most important finding, proving that cannel tar is amenable to treatment in the vapour phase process even though the temperature at which the cannel is carbonized is that normally used in a continuous vertical gas retort. The yield of spirit is certainly less than if the cannel were carbonized at a low temperature; in practice this means that the output of a given hydrogenation plant would be less.

It is probable that the optimum temperature for the treatment of cannel tar is about 480° C. and possibly in the neighbourhood of 510° C. At this temperature cannel tars would give a spirit yield and a rate of deterioration of the catalyst similar to those obtained by the treatment at 480° C. of low-temperature tar from bituminous coal.

The amounts of hydrogen consumed in the process are also shown in Table 10. In period 2 the total hydrogen was 4·1 per cent. for cannel tar (73 cu.ft. per gal.) compared with 5·5 per cent. for Fuel Research low-temperature tar. The cannel tar therefore requires about 1 per cent. less hydrogen.

If it were intended that the only product of hydrogenation should be motor spirit, the high-boiling oil in the liquid product would be re-cycled continuously. In this way the throughput of the plant would be reduced and the hydrogen consumption increased. In the case of low-temperature coal tar the throughput is reduced to half and the hydrogen consumption increased from 5·5 to 8·0 per cent. In the case of cannel tar the decrease of throughput would be to one-third and the increase of consumption of hydrogen to about 7·0 per cent. With complete re-cycling it may be taken that 100 gal. of cannel tar and 140 cu.ft. of hydrogen will yield 105 gal. of motor spirit and 57 lb. of wax.

The crude spirit (b.p. below 200° C.) was a stable, water-clear liquid having a specific gravity of 0·794. The composition was determined by the Manning method and compares as follows with low-temperature coal tar spirit; see Table 11. The almost complete absence of unsaturated

TABLE 11.—*Composition of Spirit from Hydrogenation of Cannel Tar and Low-Temperature Coal Tar.*

—	Spirit from Hydrogenation of —	
	Cannel Tar.	Low-Temperature Coal Tar.
1	2	3
Aromatic hydrocarbons	22	33
Unsaturated ,,	1	2
Saturated ,,	77	65

hydrocarbons shows that very little refining would be necessary. A light wash with caustic soda was sufficient to remove hydrogen sulphide and render the oil suitable for use as a motor spirit. The octane number of the spirit from cannel tar was 60 which is rather low in comparison with the 75 obtained for the spirit from low-temperature coal tar. The reason for this low octane number is the high percentage of paraffins. It is possible that further experiments at a higher temperature would improve this value.

Owing to the interest which now attaches to the production of oil suitable for the high-speed Diesel engine it is necessary to consider whether the re-cycle oil would be suitable for this purpose. It has already been shown that the oil obtained by direct distillation of the cannel tar has too high a spontaneous ignition temperature even when freed from tar acids. The hydrogenation oil however shows more promise. The entire product boiling above 200° C. was freed from wax and found to have a specific gravity of 0·893 and a spontaneous ignition temperature of 285° C. This is sufficiently low to show definite promise and compares favourably with the value of 440° C. given by the hydrogenated oil from low-temperature coal tar. Now that taxation is as much in favour of home-produced oil for the high-speed Diesel as it is for motor spirit, the production of the former is important, particularly as the cost of the hydrogenation treatment would be less if the Diesel oil were obtained as an end product, since re-cycling would not be necessary, the output of a given plant would be increased and the hydrogen consumption decreased.

Reference has been made to the fact that cannel tars contain 5·8 per cent. of solid paraffin. Hydrogenation-cracking at 480° C. affects this wax only slightly and the same proportion can be recovered from the crude hydrogenation product. That separated from the crude product from tar B was a colourless solid, of melting point 44°-47° C. amounting to 5·8 per cent. of the original tar. The fact that this melting point is lower than that of the wax separated from the crude tar indicates some hydrogenation. Re-crystallization raised the melting point of this wax to 50°-55° C.

The following conclusion may be drawn from the above examination of cannel tar. The high yield of tar obtainable by the carbonization of cannel in Woodall-Duckham vertical retorts could be utilized by subjecting it to the process of hydrogenation-cracking to which it has been shown to be amenable. The yields could be either motor spirit and wax or motor spirit, Diesel oil and wax. The spirit would have a rather low octane number. The Diesel oil might be suitable for the high-speed Diesel engine since it has a low spontaneous ignition temperature.

The proportions of spirit, oil, and wax per 100 gal. of dry tar could be 36 gal. motor spirit, 67 gal. of Diesel oil, and 57 lb. of wax. If the Diesel oil were re-cycled to yield motor spirit as the only product the yield would be 105 gal. of motor spirit with 57 lb. of wax.

An alternative market for the cannel tar would be as a pasting oil in the hydrogenation of coal; on account of its high hydrogen-carbon ratio, the tar would be a valuable raw material for mixing with the coal in order to form a paste suitable for pumping under pressure to the hydrogenation converter.

FUEL USED.

The weighed fuel used in the producers represents the gross coke as charged, no allowance being made for the heat recovered in the waste-heat boilers. When making gas in Edinburgh of a calorific value of 475 B.Th.U. with a throughput of 7·5 tons per day the average fuel consumption is 13·25 lb. per 100 lb. of coal, equivalent, at works prices, to 0·39d. per therm of gas produced. The fuel consumption in the case of cannel compares favourably with

[1] Fuel Research Technical Paper 35, 1933.

TABLE 12.—*Comparative Costs of Production of Gas from Cannel and Bituminous Coal.*

COKE, 20S. 0D. PER TON; BREEZE, 6S. 8D. PER TON; TAR, 2D. PER GAL.; STEAM, 1S. 6D. PER 1,000 LB.

—	Edinburgh—Year 1935.			Test A.			Test C.			Test D.			Test F.			Test H.		
	Quantity.	Per Ton.	Per Therm.	Quantity.	Per Ton.	Per Therm.	Quantity.	Per Ton.	Per Therm.	Quantity.	Per Ton.	Per Therm.	Quantity.	Per Ton.	Per Therm.	Quantity.	Per Ton.	Per Therm.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		s. d.	d.		s. d.	d.		s. d.	d.		s. d.	d.		s. d.	d.		s. d.	d.
EXPENDITURE—																		
Coal or cannel		17 0	2·50		21 6	2·62		21 6	2·21		21 6	2·10		21 6	2·23		21 6	2·66
Coke to producers . . cwt.	2·65	2 7·8	0·39	1·22	1 2·6	0·15	2·42	2 5	0·25	2·30	2 3·6	0·23	2·72	2 8·6	0·28	2·35	2 4·2	0·29
Steam to retorts. . . lb.	358	0 6·4	0·08	433	0 7·8	0·08	616	0 11·1	0·09	687	1 0·4	0·10	636	0 11·5	0·10	308	0 5·5	0·06
Labour		1 6·7	0·23		1 2·8	0·15		1 3·2	0·13		1 4·0	0·13		1 4·6	0·14		1 5·5	0·18
Repairs and maintenance . .		0 9·8	0·12		0 7·9	0·08		0 8·2	0·07		0 8·6	0·07		0 9·2	0·08		0 8·7	0·09
Total		22 6·7	3·32		25 3·1	3·08		26 9·5	2·75		26 10·6	2·63		27 3·9	2·83		26 5·9	3·28
REVENUE—																		
Coke for sale. . . . cwt.	9·86	9 10·3	1·45	7·47	7 5·6	0·91	6·40	6 4·8	0·66	5·00	5 0	0·49	5·00	5 0	0·52	5·42	5 5	0·67
Breeze for sale . . . ,,	2·95	0 11·8	0·15	2·18	0 8·7	0·09	2·53	0 10·1	0·09	3·92	1 3·7	0·13	3·65	1 2·6	0·13	3·92	1 3·7	0·16
Tar for sale . . . . gal.	16·0	2 8	0·39	41·3	6 10·6	0·84	42·6	7 1·2	0·73	46·1	7 8·2	0·75	54	9 0	0·92	50·3	8 4·6	1·04
Total		13 6·1	1·99		15 0·9	1·84		14 4·1	1·48		13 11·9	1·37		15 2·6	1·57		15 1·3	1·87
NET COST OF GAS		9 0·6	1·33		10 2·2	1·24		12 5·4	1·27		12 10·7	1·26		12 1·3	1·26		11 4·6	1·41
Net cost with tar at 4d. per gal. .						0·60			0·54			0·51			0·34			0·37
CONDITIONS—																		
Gas yield . . . . . therms	81·4			98·4			117			122·6			115·6			97·0		
Gas per retort . . . ,,	610			847			1,040			1,048			975			788		
Coal per retort . . . tons	7·50			8·81			8·89			8·55			8·44			8·13		
Steam, per cent. of coal . . .	16·0			19·4			27·5			30·7			28·4			13·7		

this figure, ranging as it does from 11·5 lb. to 13·6 lb. per 100 lb. of cannel carbonized, the indication being that notwithstanding the higher throughputs the gaseous products are quickly driven off, heat transference being helped by the open nature of the cannel in the retorts. The high thermal yield naturally reduced the cost per therm of gas, and it will be observed from the cost statement that this ranged from 0·23d. to 0·29d. These are very low figures indeed.

In the low-temperature test (A) only 6·1 lb. of coke per 100 lb. cannel were used in the producer. Even at this comparatively low temperature the coke was not discharged with a high percentage of volatile matter, a fact which again demonstrates the ease of carbonization of cannel.

SPECIFIC GRAVITY OF CANNEL GAS.

The specific gravity of the gas is above the normal figure for gas of a calorific value of 475-480 B.Th.U. per cu.ft., this being mainly due to the high proportion of carbon monoxide. The average is 0·520, and when this gas is mixed with relatively large volumes of coal gas it has no apparent effect. If the gas were used for enriching purposes in place of carburetted water gas the resultant mixture would have a lower specific gravity. Even at 0·520 the gas would be suitable for town gas distribution without mixing.

HYDROGEN SULPHIDE.

The crude gas produced from Newbattle cannel contains a high proportion of hydrogen sulphide. This would be expected from the high percentage of sulphur (2·4) present in the cannel. The proportion, up to 1,200 gr. per 100 cu.ft. of gas, is more than double that normally found in coal gas produced from Scottish coals, but not much above that found with certain English gas coals. If the gas were produced in large quantities due allowance would require to be made for additional purification charges in the cost sheet. Since the total cost of purification at Granton is only 0·028d. per therm of gas, the extra charge would not materially influence the production costs shown below.

COSTS OF PRODUCTION OF CANNEL GAS.

Table 12 gives a comparison of the net cost of gas per therm as produced from cannel with the average manufacturing cost at Edinburgh for the year ending 15th May, 1935, of the bench of 75 in. retorts, of which the test setting forms part. The costs have been calculated on the following bases:—

(i) The prices prevailing during the year ending 15th May, 1935, taking the coal at 17s. 0d. and the cannel at 21s. 6d. per ton delivered.

(ii) The wages on the cannel tests are taken in inverse proportion to the thermal output in comparison with bituminous coal. The averages for the latter were, for total carbonizing wages 0·23d. per therm of gas, and for output 610 therms per retort.

(iii) The costs for maintenance and repairs are also taken in inverse ratio to that for bituminous coal, which was 0·045d. per therm, or, including a depreciation item just sufficient to keep the plant in running order, 0·115d.

The costs can be compared directly only in terms of gas of 475-480 B.Th.U. calorific value, so that Test A is not strictly comparable, and Test H is comparable only

in terms of stripped gas, with an additional credit for gas spirit recovered. An immediate comparison can be made, however, in terms of those tests which produced gas of 475-480 B.Th.U. Tests C, D, and F have been taken as typical of these. It will be seen in Table 4 that, notwithstanding the additional 4s. 6d. per ton paid for cannel, the net cost of gas per therm is slightly less; the coal figure is 1·33d. and the cannel figures 1·27d., 1·26d., and 1·26d. respectively for tests C, D, and F. In the low-temperature test A the figure is 1·24d., but the gas is of higher calorific value, 562 B.Th.U., and presumably of greater value. In Test H, where the calorific value was 514 B.Th.U. per cu.ft., the net cost was rather higher, being 1·41d. per therm. If spirit were recovered to bring the calorific value down to 475-480 B.Th.U., the net cost would become appreciably lower (1·23d.), assuming a net credit of 7d. per gal. for the spirit.

The cost figures have been calculated, using the present market rate for gas works tar. If, however, the tar could be utilized for hydrogenation purposes and a price of 5d. per gal. realized, less 1d. for rail and tank charges—a price which its high hydrogen-carbon ratio more than justifies—the net costs of gas fall to the very low figures of 0·54d. to 0·37d. per therm. Such low figures suggest the possibility of the centralizing of hydrogenation plant to make full use of any cannel deposits of a quality comparable with that used in these tests and available in sufficient quantity over a reasonable period of years.

CONCLUSIONS.

(1) Newbattle cannel forms a suitable material for carbonization in continuous vertical gas retorts. Owing to its weak caking power, sized material only can be used if a lump fuel is to be produced.

(2) Cannel coke is rather smaller in size than the cannel charged, but is strong, hard, and readily combustible. It is suitable for closed stoves and for the open domestic grate. The yield of graded coke is about 7·2 cwt. per ton of cannel.

(3) The yield of gas is high, and as much as 30 per cent. of steam can be used while producing a gas of 480 B.Th.U. calorific value. The yield of gas is about 120 therms per ton of cannel, or about 1,050 therms per retort per day.

(4) By stripping the gas a yield of 4·6 gal. of crude spirit per ton of cannel can be obtained. If a calorific value of 480 B.Th.U. were necessary in the stripped gas, steaming would be limited to about 14 per cent. and the yields would be 90 therms of gas and 4·1 gal. of refined spirit. The spirit is not a benzole, but has an octane number of 70, and would make a satisfactory motor spirit.

(5) A high yield of 40-50 gal. of tar is obtained per ton of cannel. This tar is as amenable to hydrogenation as low-temperature tar, and can yield 105 per cent. by volume as motor spirit, and 57 lb. of paraffin wax per ton cannel. Alternatively a proportion of Diesel oil of fairly low spontaneous ignition temperature can be produced, 100 gal. of tar giving 36 gal. spirit, 67 gal. Diesel oil, and 57 lb. of wax.

(6) Under the stated conditions the gas costs less to produce than that from Scottish gas coal and, if the tar could be sold for hydrogenation purposes, the cost of production of the gas could be as low as 0·5d. per therm.

(7) Since cannel is a material which may vary considerably in composition, it is understood that the above conclusions refer only to the cannel dealt with in this investigation.

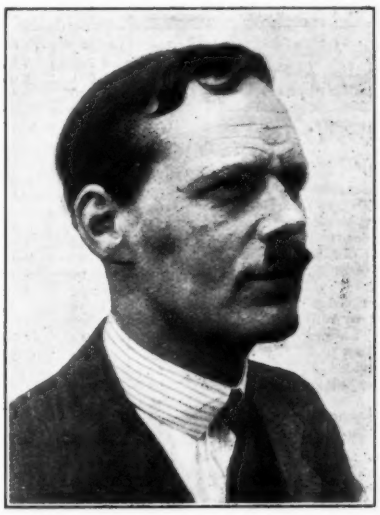
(Communication No. 134)

Gas Safety Precautions

by

C. A. MASTERMAN

(Chief Technical Officer, Gas Light and Coke Company)



C. A. MASTERMAN, M.A. (Oxon.), M.I.Mech.E., F.I.C.

Mr. Masterman was educated at Gresham's School, and gained a Natural Science Exhibition, Balliol College, Oxford, in 1914. After the war he resumed his studies at Balliol College, reading chemistry. After taking the Degree of B.A., he remained at Oxford on research for the War Office, and later was appointed Senior Assistant in the Defensive Munitions Department at the Experimental Station, Porton. Mr. Masterman joined the Gas Light and Coke Company in 1927, becoming Senior Chemist, and later Chief Technical Officer in charge of the laboratories and other activities at Watson House.

INTRODUCTION.

The Report to the Board of Trade of the Departmental Committee on Deaths from Gas Poisoning, 1930, contains the following conclusions:—

> "While the number of deaths by suicide from coal gas poisoning in Great Britain in recent years has shown a large and disquieting increase, the number of accidental deaths from such poisoning shows, on the whole, no appreciable increase and remains at a figure which, we consider, gives no cause for alarm.
>
> We believe that, to a large extent, the increased number of gas suicides denotes merely a change in the suicidal means adopted.[1]
>
> We appreciate, from what we have heard in evidence and from apparatus and fittings which we have inspected, that much is being done by some gas undertakings to ensure that the types of gas apparatus used by consumers shall be satisfactory from the point of view of safety, and that the material and method of construction of pipes, fittings, and other apparatus are carefully examined. We are not satisfied that all undertakings are sufficiently alive to the necessity for similar action on their part, with a view to preventing accident and to making the use of gas safer and, therefore, more popular. We think that it might be found possible to make arrangements within the industry whereby the work done in this way by the larger and more efficient undertakings could be extended for the benefit of the consumers of gas supplied by other undertakings.
>
> We think that much could be done by makers of gas apparatus and by gas fitters (whether employed by gas undertakings or not) to prevent mistakes in the use of gas taps, and to avoid the placing of taps in positions where they can easily be turned on acci-

[1] This is borne out from reports in Hameln where "non-poisonous" gas is manufactured; two would-be suicides by Gas, having failed, proceeded to take their lives, one by hanging, one by drowning.

dentally and unnoticed by the occupants of the room. Also, in designing gas apparatus, makers should have constant regard to the prevention of accident."

The lapse of time since this Report was published, the closer contact which has since been established between undertakings and suppliers, and the setting up in other countries of official organizations for the testing especially of gas appliances, all suggest the present as a suitable occasion for a review of the situation and discussion as to what remains to be done.

All members of the Gas Industry are familiar with sensational press reports of gas fatalities; some have had the unhappy experience of contact with the bereaved or with the coroner subsequent to such accident. There is every reason—personal, social, and commercial—to take every practical precaution to eliminate accidents due to the use of Gas.

It is, perhaps, characteristic of the British nation that, while efforts to ensure safety to consumers are apparently much less impressive than those of many other countries, the fatality rate from manufactured gas in relation to output has been variously estimated[2] as from one-fifth to one-twentieth the average of the world. The annual accidental deaths from town gas are less than a quarter those due to either drowning or falling downstairs, and do not much exceed those due to horse-drawn traffic. Fatalities due to the products of combustion are less than those due to motor car fumes, less than half those due to insects or to blows at cricket or football, and about one-tenth those due to falling out of bed; see Table 1.

TABLE 1.—*Analysis of Violent Deaths, England and Wales; From Registrar General's Report.*

—	1931.	1932.	1933.	1934.
1	2	3	4	5
TOTAL VIOLENT DEATHS	21,578	21,869	22,680	22,731
Suicides	5,147	5,743	5 656	5,550
Mechanically-Propelled Vehicles	5,892	5,671	5 934	6,043
Burns or Conflagrations	891	820	866	914
Drowning	685	833	925	600
Falling Downstairs	662	611	713	738
Scalds	504	483	471	453
Railways	399	402	397	461
Suffocation	428	422	392	411
Building Operations	230	204	222	244
**Accidental Deaths from Coal Gas*	163	154	162	141
Horse-drawn Vehicles	125	138	121	127
Water Transport	127	143	127	116
Falling from Window	80	83	101	86
Falling out of Bed	70	66	106	92
Electricity	56	55	70	67
Swallowing Foreign Bodies	53	56	56	63
Horse, Cow, or Bull	49	58	41	55
Falling from Ladder	52	54	55	62
Excessive Heat	12	103	146	56
Excessive Cold	24	20	37	16
Blows at Football or Cricket	21	27	26	35
Insects	16	30	25	23
Motor Car Fumes	11	12	5	10
Products of Gas Combustion	6	10	10	9

* These returns include as a substantial proportion those referred to in the Paper as of unstated nature.

The more closely is vanishing point in the incidence of gas fatalities approached the more difficult does further improvement become. The Industry cannot, however, remain content so long as there occurs a single preventable accident. It is the purpose of this Paper to raise the question for discussion whether there is more that the Industry can do, not only to fulfil the primary requirement of safety, but the wider requirement of ensuring to consumers fully satisfactory service from all their gas appliances.

CAUSES OF ACCIDENTS.

Fatal accidents may first conveniently be considered, since it is of them that the most nearly complete statistics are available. As a matter of interest, about twice as many fatal gas accidents occur in the winter as during the summer.

Analysis of the circumstances suggests that a proportion as high as 25 per cent. fall within the category "really cases in which there was great likelihood of suicide, the jury or coroner, as the case may be, not being prepared to give a definite verdict to that effect."[3] Of the accidents almost certainly accidental, the following statistical analysis may be made:—

Unburnt gas	77 per cent.
Products of combustion	9 ,,
Industrial or unclassifiable	14 ,,
	100 ,,

Fatal accidents due to unburnt gas may be further subdivided as follows:—

Accidental escapes, defective pipes, meters, or fittings	16 per cent.
Prepayment meters	4 ,,
Disconnected or defective flexible tubing	5 ,,
Appliances	2 ,,
Taps left on or mistaken	73 ,,
	100 ,,

Analysis of the ages of the victims of fatal gas accidents shows that the aged are more accident prone, the rate for persons over 80 years of age being thirty times that for the young or middle-aged. It is probable that this is to be attributed to mental confusion in causation of the accidents rather than to physical inability to withstand the results.

Extreme old age, illness, or drunkenness are associated with about 25 per cent. of the fatal gas accidents reported. Thus the relatively small number of fatal gas accidents is reduced to about half if fatalities truly accidental and primarily due to gas alone be considered.

Explosions, rarely if ever with fatal results, represent another type of accident of which a statistical review is possible, since the damage usually comes to the notice of the gas undertaking. A complete record is kept of all such explosions from the several millions of gas appliances on the area of the Gas Light and Coke Company amounting per 10,000 consumers to 3·5 in 1934 and 2·7 in 1935. In a number of cases these explosions were not properly due to the appliance, but to a variety of causes, one, for instance, being traced to a tin of peas on the hotplate.

The main cause with water heaters is incorrect lighting, while explosions on cookers are due chiefly to turning on the oven tap but not lighting the burners. Of the latter type we now have less than one-third the number we had in 1929, in part due to the more general introduction of the bottom flue outlet and safety type tap.

Of the outbreaks of fire reported as due to Gas during 1934, less than half were confirmed as really due to this cause, and, of these, three were of the supposedly familiar type of using a candle to locate a gas escape!

RESPONSIBILITY FOR SAFETY.

The maintenance of safety to the consumer in this country is a service with which both the reputable gas appliance manufacturers and the gas undertakings are concerned, probably more actively than any other industry. For instance, it would be difficult to visualize the oil companies, in the interests of safety, influencing the design of motor cars or hesitating to supply petrol to the driver of a defective vehicle; in these circumstances it is clearly understood that the owner or driver of the car is a free agent, yet a journey in a motor vehicle for one mile is statistically more hazardous than is the operation of a gas appliance over the whole of its effective life. The Gas Industry, for various reasons, takes a different view and at any time is prepared to put difficulties in the way of the consumer wishing to use Gas in a manner or for a purpose which it considers to be unsafe or unsatisfactory, even at the cost of that consumer's goodwill.

The author jointly presented to the 72nd Annual General Meeting of the Institution a Paper dealing with the policies in other countries governing the testing of gas appliances.[4] It was there suggested that the setting up in this country of a rigid national system of test might even have an adverse effect upon the number of gas accidents, owing to the tendency thereby to remove the sense of responsibility from all concerned with the installation and maintenance of gas appliances in the consumer's home. Rigid regulations tend to cramp development, to cause makers to design to the lowest acceptable standard, and to breed a false sense of security in all those who make contact with an appliance or fitting which is stamped as having been "approved."

It would be possible to embark upon almost limitless expenditure and interference with consumers' installations in ill considered precautionary measures. Safety is, however, one aspect only of the proper functioning of gas installations and, in ensuring proper service from Gas,

[2] "Deaths from Gas Poisoning," Stadtgas-Entgiftung by Schuster; Publ. Hirzel, 1935; Leipzig. See also Appendix to this Paper, "Comparative Statistical Summary of Fatal Accidents in Different Countries."

[3] Report to the Board of Trade of the Departmental Committee on Deaths from Gas Poisoning.

[4] "National Policies Governing the Testing of Gas Appliances," by S. Lacey and C. A. Masterman; Publication Inst. Gas Eng., No. 109/14, 1935.

consumers are also safeguarded from accident. In the various aspects of this type of service the policy and experience of the Gas Light and Coke Company may be of interest, and are detailed in the following sections.

TESTING.

It is the practice of the Gas Light and Coke Company that the raw material of gas utilization, such as pipes, fittings, and materials, is subject to an extensive system of specification and routine test, representing an annual cost of about £20,000 exclusive of laboratory work. This large sum represents less than 1 per cent. of the cost of the items so controlled. Even this cost is apparent rather than real, since it enables substantial savings to be effected in buying prices, while the results of maintaining a rigid standard diminish the amount of defective material reaching the district and therefore diminish the great expense inevitably involved in exchanging defective material after installation. The maintenance of these standards must also be of benefit to the Industry at large, since to an increasing extent suppliers of materials and the like find it in their own interests themselves to carry out tests on their products.

For the testing of gas appliances a number of gas undertakings and gas appliance manufacturers maintain laboratories which work to standards which have been the subject of common discussion, although they have not been systematically and rigidly specified. In these tests the safety aspect is the first which is considered. The products of combustion are tested to ensure that they are satisfactory under such conditions as may obtain in practice. The construction of the appliance is examined to ensure that a satisfactory combustion standard will continue to be maintained. The efficiency of performance is tested to ensure that satisfactory service will be given to the consumer at a gas rate consistent with proper combustion. This work, too, by maintaining a high standard in gas appliance design, is of benefit to the Industry and to the community as a whole.

The safety devices, valves, burners, and the like are examined and tested to safeguard against failure under practical conditions; flue equipment, if any be provided with the appliance, *e.g.*, bafflers, are tested to ensure satisfactory performance. The safety aspect alone, in view of the rarity of gas accidents, would perhaps scarcely justify these activities, but they are activities common to the provision of a generally satisfactory service to the consumer, without which the Industry cannot progress.

No such activities, however, can by themselves guarantee satisfactory service: at most they guarantee that the materials, fittings, or appliances are potentially satisfactory, and will be satisfactory if properly installed and properly looked after.

The necessary complement, therefore, to this testing policy is the adequate training of personnel. This training applies not only to newcomers into the Company, but is necessary also with experienced personnel in order to keep them up to date with the rapid progress in appliances and technique now taking place. The aim is to ensure that all the Company's district personnel, of whatever grade, are brought up to date by direct instructional courses at least once a year; see Table 2. In addition to these courses, demonstrations are given periodically, a Bulletin of technical information is issued monthly, and an Information Bureau is maintained from which information can be given on the telephone, and from which expert personnel can be sent out to deal with specific problems. In view of the importance of the human factor, it is not inequitable that the cost of training represents an even larger sum than the cost of the routine testing of appliances and materials.

SAFETY DEVICES.

The analysis of accidents referred to already in this Paper emphasizes that the majority are connected with the misuse of taps. Development is continually in progress to diminish any possible confusion in the consumer's mind as to the correct operation of taps and to prevent taps being accidentally turned on. The position of the tap on the appliance is important, and the Gas Light and Coke Company is endeavouring to ensure that taps in positions which may be considered in any way vulnerable are all of a safety type—usually with hinged thumb piece.

The introduction of tap-operated ignition on certain appliances is likely to be still further developed and so will further remove the chance of unburnt gas being able to

TABLE 2.—*Outline of Training Courses and Accommodation available for Training; The Gas Light and Coke Company.*

Type of Training.	Duration of Course.	When Held.	Maximum Number of Trainees in Class.
1	2	3	4
STAFF.			
Staff Pupils: Actual Training—2 years; Probationary Appointment—1 year	3 years	Commencing annually	As required
Salesmen and Showroom Attendants: Part *a*. *Technical—10 weeks; Part *b*. Clerical and system—3 weeks; Part *c*. Sales Training—7 weeks.	5 months	4 per annum, commencing every 3 months	20 (2 classes can run concurrently)
Foremen: Complete course in Technical and administrative duties. Equivalent to City and Guilds Final Grade	2 months	As required	12
Service Supervisors: Industrial and Technical Representatives	3 weeks to 2 months according to trainees' technical qualifications	As required	12
Staff Lectures and Demonstration of new appliances and developments	½ day	4 per annum	200
Approved Dealers' Salesmen	2 weeks	As required	20
WORKMEN.†			
Apprentices	6 years	Commencing annually	(about) 60
Course "A":—Lighting, Fires, and Flueless Heaters	1 week	Continuous	30
Course "B":—Cookers and Washing Machines	3 days	Continuous	30
Course "Cm":—Instruction in Water Heater maintenance	1 week	Continuous	30
Course "CF":—Instruction in Water Heater installation	1 week	Continuous	30
Course "D":—Joint Wiping	1 week	Continuous	30
Course "E"/"F":—General Gas Fitting and complete installation work	2 weeks	Continuous	30
Course "G":—Storage Heaters, Circulators, and Refrigerators	1 week	Continuous	30
Meter Reading	1 day	Continuous	30
WORKMEN'S REFRESHER COURSES.			
Course "R":—General Refresher Course. Each trained man attends once per annum	2–3 days according to subject matter available	Continuous	40

* Equivalent in standard to Ordinary Grade Gas Supply Course of The Institution of Gas Engineers.
† Refresher Courses are available in all courses from "A" to "G" above

pass into the room by reason of mistaken operation of taps. Its development clearly is not coming about primarily as a safety precaution, but as an added convenience to the consumer.

The development, also, of more stable pilot lights will decrease the already remote chances of accident from unburnt gas or explosion, but, chiefly, will be an improvement in gas service and in economy by reason of the lower gas rate of such pilots.

In relation to fire hazards there are a number of obvious precautions which can be and are taken, such as the provision of adequate fire guards, the maintenance of flue outlet, and surface temperatures below dangerous limits, &c.

The re-establishment of the gas supply by the insertion of a coin in a prepayment meter suggests the possibility of accident from this cause if the appliance or burner unwittingly be left in operation. Statistics show that accidents due to this cause are extremely rare.

Where gas appliances are used of a type likely to be in continuous operation on prepayment meter, a cut-off fitting may be used, which must be specially operated by hand before the gas supply to the appliance is re-established. Alternatively, there are now a number of appliances where a pilot light is involved, the full gas supply to the appliance only being maintained so long as the pilot is actually alight. The heat from the pilot actuates a bimetallic strip which causes the valve to keep open just so long as the strip remains hot. In theory, such a fitting could be required to be universal on all burners, thus avoiding, while the fitting worked, any accidents due to extinction of the Gas. If, however, a proper perspective be maintained, it is more than doubtful if it would be justifiable to require all consumers to undertake the expense and inconvenience associated with the universal introduction of such a fitting in the interests of the minute number of potential victims. Sentiment and the proper valuation of human life are inescapable factors, but in other aspects of life we find hazard much less remote happily accepted without the establishment of inconvenient and expensive precautions which, in the long run, the user or consumer is called upon to finance. There has recently, for instance, been some acute criticism in the Press of the additional safety precautions proposed to be enforced by the Electrical Industry, whose fatality rate in proportion to their fewer consumers and smaller energy output, and whose responsibility for the causation of fires, are substantially in excess of that of the Gas Industry.

COMBUSTION AND EFFICIENCY.

As a result, partly of inadequate information and partly of press reports, considerable attention is paid to fatalities from the products of gas combustion, especially following periods when possibly two or three such fatalities have occurred within a short space of time. The air of mystery and misunderstanding which may surround such accidents gives to them additional and quite unwarranted prominence. The closest enquiry into such cases as have happened brings to light the fact that the reasons for such accidents are not mysterious, but are to be attributed to certain well-defined causes. With an average for the whole country of nine or ten such fatalities per year for the last few years, the situation here is very different from that which at one time existed in America[5] where, in one city alone, and in one month alone, 28 fatal accidents occurred owing to incomplete combustion, the causes of which were then quite unknown.

With few exceptions, incomplete combustion leading to the production of carbon monoxide in the products of combustion is due to excessive gate rate, and there are few appliances the gas rate of which cannot be so reduced as to ensure satisfactory combustion.

A dangerous appliance in respect of combustion may be defined as one which is inadequate to perform its proper service if the gas rate is such as to ensure proper combustion. The tests for efficient service are therefore, even in this narrow sense, essentially related to safety considerations.

The correct gas rate for an appliance is normally determined in the laboratory on a sample of the appliance. This gas rate must allow a margin for variation between the sample tested and bulk deliveries, for variations in adjustment, for variations in gas quality and pressure, and for the effect of corrosion deposits and the like. It is generally agreed that for ungoverned appliances, this margin should be 100 per cent. pressure overload (40 per cent. gas rate overload) and for governed appliances 25 per cent. gas rate overload. There remains, however, the difficulty of judging what overload should be allowed in the case of the small uninformed manufacturer, successive samples from whom may show wide departures from standard.

It will be fully appreciated that incorrect gas rate, due to mal-adjustment, changes in gas quality or pressure and the like, while they may rarely lead to danger, will frequently lead to indifferent service, to ensure against which requires considerable attention and expense, both in installation and maintenance. If the appliances be fitted before issue with governors and fixed orifices, not only is this expense and uncertainty avoided, but the consumer can conveniently be given more reliable service which, at the same time, is fuller in that the gas rate can be increased to 25 per cent. in excess of that otherwise allowable. For appliances, such as cookers, Duplex fires, &c., where the gas rate requires to be capable of manipulation by the consumer, a pressure governor appears the appropriate method of control. For appliances which normally operate only at full gas rate, *e.g.*, geysers, there are advantages connected with the use of volume governors in so far as they are sealed from the air and are independent of error in or damage to the burner or injector. Such volume governors, in that they accommodate a large gas rate, are clearly less delicate and less susceptible to error than are the small volume governors hitherto familiar, chiefly in connection with lighting burners.

The use of governors as an integral part of the appliance has been proposed in Australia as an essential prior to approval of the appliance. Such governors do not require to be precision instruments, and can therefore be manufactured at such cost as to be an economy compared with the cost of the attention to be given in adjustment and the like in their absence. Their use leads to the gas appliance being capable of installation and operation without more attention than is required for electrical appliances.

The Gas Light and Coke Company has now issued over 100,000 cookers with pressure governors and fixed injectors, together with many thousands of single point instantaneous water heaters having a pressure governor as an integral part of the gas-water valve. To an increasing extent governors are now being used in the design of flueless heaters. The decision to adopt these devices has been justified; they have fulfilled their object in decreasing installation and maintenance costs and in guaranteeing full service to the consumer.

Governors, whether of the pressure or volume type, must inevitably be susceptible in some degree to the presence of foreign bodies or gum in the Gas, and their introduction is therefore qualified by the condition of the Gas in this respect. Where governors are not used, the process of correctly adjusting the gas rate of the appliance can be facilitated by the use of fixed orifices in conjunction with a pressure testing point. The policy of standardizing orifice size, whether with or without governors, is, of course, facilitated by the size of the Gas Light and Coke Company, which is in a position to buy large numbers of appliances, all of which will operate on Gas of one fixed calorific value and limited variation in specific gravity and flame velocity. The present variations throughout the country in calorific value and other qualities might throw an intolerable burden on the appliance manufacturers if they were to be required to supply to each undertaking appliances pre-set to each particular gas quality. If this be so, the Gas Industry and the gas consumer pay a heavy price in money and in service for the liberty in manufacturing processes each undertaking can exercise.

UNSATISFACTORY APPLIANCES IN PRIVATE OWNERSHIP.

There must inevitably remain sources of supply of gas appliances other than through the gas undertakings. Not all of these appliances will necessarily be of good design or satisfactory construction. It might be held that the possession and use of such appliances is solely the responsibility of the consumer, but any accident with such appliances is liable to reflect, however unfairly, to the discredit of the local gas undertaking and to the Gas Industry at large. In many cases, therefore, the undertakings invite consultation from consumers regarding their appliances, even though these have not been bought through the undertaking itself.

There will, however, remain a number of consumers who, for one reason or another, feel they are obtaining satisfactory service from their privately owned appliances, whereas, in fact, they may be inviting some degree of hazard, whether by reason of the unsatisfactory connections to the appliance, taps and controls, or of the combustion.

If some responsibility for these appliances be accepted by the undertakings, then expense must be faced in tracing their existence and in putting them in order. In the Gas

[5] It may be of interest to note that while the introduction of a rigid national system of test in America appears to have reduced the number of fatal gas accidents per annum by 50 per cent., such accidents in that country in proportion to the sales of manufactured gas still greatly exceed those in Great Britain.

Light and Coke Company at the present time there is a small organization at work whose chief object is the tracing of such appliances. Any necessary cleaning of the flue ways and adjustment of the gas rate is carried out free of charge prior to attempts to persuade the owner to enter into a maintenance contract. If more substantial changes are required, such as exchange or provision of flue equipment, this is done at cost, while appliances which cannot be made completely safe, and, at the same time, be operated to give satisfactory service, are criticized with a view to persuading the consumer to discontinue their use. In order to encourage exchange, an allowance is given of 10 per cent. of the value of the new appliance chosen. Our special examiners visit only those premises in which privately owned appliances are known or thought to be installed. In less than 5 per cent. of the cases have consumers refused to allow their appliances to be examined. Of those examined, about 33 per cent. were found in some degree to be unsatisfactory, not all of these, of course, being necessarily dangerous. In over half of these cases the owners agreed to allow the desirable changes to be made or the appliances to be replaced. Of the total privately owned appliances examined, in nearly 25 per cent. of the cases the owners were persuaded to enter into maintenance contracts. Where the owner was unprepared to allow matters to be corrected, a " follow up " letter was sent explaining the conclusions reached as a result of the examination and emphasizing the desirability of putting matters right. The precise form of this letter requires consideration in order that it shall be sufficiently emphatic to receive proper consideration by the consumer without unduly stressing a danger which, in most cases, is extremely remote.

GENERAL.

The influence of the larger undertakings and the reputable gas appliance manufacturers is continually being exercised to stimulate improved design, construction, and installation of gas appliances, not only in the interests of safety, but to ensure generally satisfactory service. These efforts, however unco-ordinated they may seem, have had a marked effect. There remains, however, the need for closer co-operation throughout the Industry, and it will be common knowledge that such co-operation is showing substantial improvement. It is to be hoped that, in the near future, there may be set up for domestic gas appliances and installations an organization not dissimilar from that which for some time has been successfully operating in connection with the Industrial use of gas. The discussions and personal contacts so achieved will be more fruitful than would be the imposition of rigid rules or inflexible specifications. The Domestic Gas Appliances Committee should undertake, as one of its first duties, the drafting of model regulations of a general nature regarding gas equipment. This should put the necessary elementary safeguards on a proper footing and avoid the confusion which repeatedly arises from well-intentioned regulations of an uninformed kind with which we often find ourselves confronted. There are some who, especially in a lively recollection of some recent gas fatality, feel inclined to advocate a greater degree of detailed regulation and authority to inspect installations than exists at present. The drafting of such regulations and authorizations is by no means a simple matter, and the Author is convinced that—as has been the experience in other countries—such attempts at rigid detailed control would soon be found to be extremely onerous and cramping to progress. The Industry should be prepared to accept such burdens if they were likely to result in the removing of the hazard and saving of life, but the Author is convinced that they would not be beneficial. A policy of closer personal co-operation between all those concerned with gas utilization is preferable, whereby all can achieve a better understanding of the problems and better profit by the experiences of others.

APPENDIX 1.—COMPARATIVE STATISTICAL SUMMARY OF FATAL ACCIDENTS IN DIFFERENT COUNTRIES.

Compiled from Statistics provided by The Institution of Gas Engineers.

Country or City	Great Britain.	Germany.	Switzerland.	Vienna.	U.S.A †
Year (most recent of which statistics are available)	1934.	1933.	1933.	1934.	1933.
1	2	3	4	5	6
Total population . . . . . Millions	49·5	66·0	4·1	1·9	122
Total population supplied with gas . . ,,	45	37·2	2·3	0·5	45
Manufactured town gas sold per annum . Million cu.ft.	290,600	155,000	8,780	9,000	400,000
Accidental deaths (all causes, including suicides) total	27,012	41,183	3,498	2,214	..
Suicides . . . . . ,,	6,252	18,723	1,126	1,055	..
Deaths from road traffic . . . . . ,,	7,480	7,386	505	175	30,500
Deaths from electricity . . . . . ,,	74	248	31	3	..
Suicides from gas . . . . . ,,	1,943	2,811	162	397	..
Accidental deaths from gas . . . . . ,,	172	497	9*	36	1,000
Accidental deaths (all causes, including suicides) . . . Per million of population	546	622	851	1,161	..
Suicides . . . . . ,, ,,	126	283	275	556	..
Deaths from road traffic . . ,, ,,	155	112	123	92	254
Deaths from electricity. . . ,, ,,	1·5	3·8	7·4	1·6	..
Suicides from gas . . . . ,, ,,	39	43	40	210	..
Accidental deaths from gas . ,, ,,	3·5	7·5	2·2*	19	8·2
Accidental deaths from gas per million gas users. . .	3·8	13·3	3·9*	72	22
Accidental deaths from gas per 1,000 million cu.ft. gas sold	0·6	3·2	1·0*	4·0	2·5

* 1935.

† These figures for U.S.A. are estimated from information supplied by the American Gas Association and other sources. The considerable usage of Natural Gas which is excluded from these figures render difficult any precise comparison with other countries.

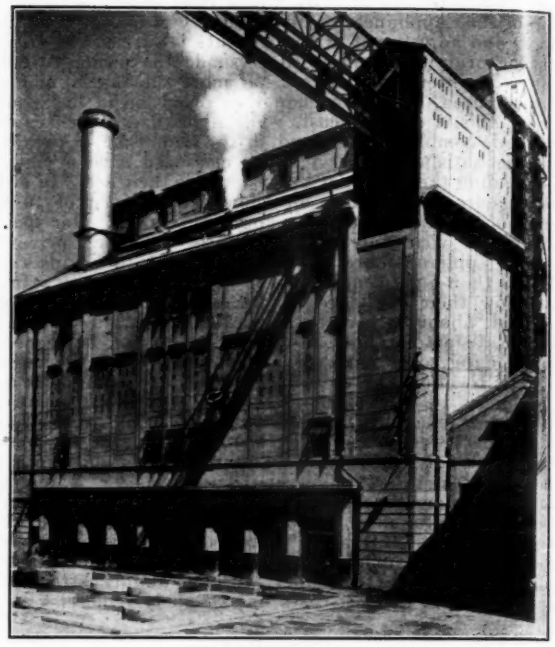
(Communication No. 136)

The New Gas-Works at Shanghai

by

W. J. BAKER

(Engineer-in-Chief and Manager, Shanghai Gas Company, Ltd.)



The Woodall-Duckham Retort House at Shanghai.

The object of this paper is not to describe thoroughly all details of the construction of a new gas works but rather to give a descriptive account of the design and construction of the plant and buildings. The detailed cost analysis given is not immediately comparable with similar constructional work in England because of the lower rates of pay of native labour, the varying rate of exchange between pounds sterling and Chinese dollars and the various Customs import duties and other taxes imposed on materials imported into China.

Throughout the paper except where otherwise stated the rate of exchange is taken at 1s. 3d. to one Chinese dollar.

Shanghai is in reality three cities in one, with three separate municipal administrations claiming jurisdiction over the business and welfare of the residents. The International Settlement is controlled by the Shanghai Municipal Council, the French Concession by the French Municipal Council, and the Chinese Area beyond these two districts by the City Government of Greater Shanghai. The Company, therefore, negotiates with all three administrations.

An analysis of the gas sales during 1934 shows that:—

65	per cent.	was used for	cooking and water heating
32	,,	,,	,, industrial heating purposes
1·8	,,	,,	,, public lighting
1·2	,,	,,	on Works

from which it is seen that the Company has no power load and a negligible lighting load.

An analysis of the nationality of gas consumers proved that there were approximately:—

3,670	British
640	French
224	German
987	Russian
2,814	Chinese
2,297	Japanese
176	Indian
2,633	Others, including American and Portuguese.

The Chinese, Japanese and Indian consumers demand special types of cooking appliances on which to prepare their respective native dishes.

Competition from other fuels is extremely keen, and electricity is sold for:—

Lighting	at	$0.168 (2·52d.)	per kWh
Cooking and heating	,,	$0.04 (0·6d.)	,,
Water heating . . .	,,	$0.03 (0·45d.)	,,
Power	,, between $0.03 and	$0.062 (0·93d.)	,,

Gas is sold at $2.85 (3s. 6·75d.) per 1,000 cu.ft. for cooking, 9·72d. per therm, and at $2.25 (2s. 9·75d.) per 1,000 cu.ft. for water heating, 7·7d. per therm, but only consumers who use a cooking appliance as well as a water heater are eligible for the lower rate of $2.25 per 1,000 cu.ft. Gas sold for industrial purposes is subject to a sliding scale.

The comparative cost of Gas and electricity for cooking, $2.85 per 1,000 cu.ft. to $0·04 per kWh, gives on a cubic foot to unit basis a ratio of 71 to 1. The comparative figures for water heating, $2.25 per 1,000 cu.ft. and $0.03 per kWh, give a ratio of 75 to 1.

These rates of 0·6d. and 0·45d. for electricity are probably the lowest on record and it may cheer many a faint heart to know that Gas for cooking and water heating still holds its own in Shanghai and that the Company obtains the higher percentage of all new business. The number of consumers who oust Gas and install electricity is negligible: the competition is of course very keen and the cost of publicity is great, amounting to $42,000.00 or approximately £2,500 during 1934.

Oil holds the field for central heating in large buildings, Chinese coal at $16.00 (£1 0s. 0d.) per ton being a dangerous competitor.

Unfortunately such coal is unsuitable for gas making owing to its high ash content and poor coking qualities. The Company's coal supplies are mostly imported from Japan and incur a Customs import duty of approximately $4.00 (5s. 0d.) per ton, resulting in the price of coal being at times $20.00 per ton, *i.e.*, approximately £1 5s. 0d., but depending on the rate of exchange between Japan and China.

Owing to the continual movement of the majority of Shanghai residents, who live in the city for a period of three to five years and then return to Europe or America on long leave, it is impossible to sell domestic gas appliances outright or on a hire purchase system. All appliances are therefore installed on a simple hire—the hire charge being just sufficient to cover the capital charges on the apparatus.

The Shanghai Gas Company was formed in 1862; the Works were erected on a site at the junction of Soochow Creek and Thibet Road and on 1st November, 1865, Gas was available for lighting purposes.

During the year 1930 it was realized that the plant existing at that time was very inefficient and approaching the end of a useful life. Various schemes were considered for erecting new plant on the Thibet Road site, but the awkward position of the available vacant land presented many structural difficulties, and it was eventually decided to build a new works on a new site.

The final scheme adopted allowed for new manufacturing and purification plant on a new site and a high pressure pipe line connecting the new plant to the gasholders situated on the east side of Thibet Road. The scheme was to be financed by the sale of the site on the west of Thibet Road, the area of which was approximately five acres with a sale value at that time of $925,000 (£58,000) per acre. During the year 1931 a Whangpoo River site 5½ acres in area was purchased at a cost of approximately £12,900 per acre. The site was 160 ft. wide and 1,425 ft. long and lent itself to a much more satisfactory layout of plant than did a square site of larger area.

PRELIMINARY CONSIDERATIONS.

During preliminary investigations it was decided that any new plant was to be as labour saving and mechanical in operation as possible. The general opinion appears to be that eastern native labour is excessively cheap: Chinese labour is cheap, but the individual labourer is physically weak and at least three Chinese are required to perform any manual work which would be done by one British

labourer. For example a machine charged bench of horizontal retorts in 20 settings of eights required 37 Chinese stokers per eight hour shift.

The rate of pay for Chinese labour has increased enormously during the past 15 years as shown below:—

Wages for Working Day.

	Stokers.		Coolies
1920	$0.55 (8·25d.)	..	$0.35 (5·25d.)
1925	$0.75 (11·25d)	..	$0.48 (7·2d.)
1935	$1.21 (1s 6·15d.)	..	$0.81 (1s. 0·15d.)

A further point in favour of mechanically operated plant was the uncertainty of Chinese labour; in the event of a strike, it was considered that the foreign staff of 50 men could operate such a plant over a long period.

Therefore taking these points into consideration, *i.e.*, the high cost of land and the increased cost and uncertainty of native labour, it was finally decided to install mechanical coal handling plant in a closed store, vertical retort plant, and mechanical coke handling and screening plant.

Bearing in mind the very high cost of land, the author in designing the Works had to arrange a layout of the plant to prevent even the slightest waste of ground area. Figure 1 shows the final layout adopted for the 4 mill. cu.ft. per day new plant, planned for extensions to provide an output of 8 mill. cu.ft. per day.

The coal store was designed with a capacity of 5,500 tons, ample ground area being left adjacent to the building for a further store of larger capacity.

The vertical retort house was to provide an output of 4 mill. cu.ft. per day, and was arranged for extensions to produce a maximum of 10 mill. cu.ft. per day.

The storage hoppers for screened coke were designed with a capacity of 300 tons with sufficient ground area to extend for a further 300 tons capacity.

The water gas plant was placed between the retort house and the screened coke hoppers, thereby allowing coke to be fed direct from the telpher skips into the generator hoppers.

When considering the purification plant, advantage had to be taken of the old plant existing at Thibet Road Works which would eventually be transferred, but owing to such plant being then operated to its full capacity it was essential to arrange new purification plant to deal with the entire make of Gas until the old plant was put out of commission.

The plant to be transferred was:—

One exhauster; 200,000 cu ft. per hour capacity
Two washer scrubbers; each 1 mill. cu.ft. per day capacity
One Livesey washer; 2 " " " "
One oxide purifying plant; 2½ " " " "
One 30 ft. 0 in. by 9 ft 0 in. Lancashire boiler
One 28 ft. 6 in. by 7 ft. 0 in. " "

The new condensing plant was arranged as two sections of vertical water tube condensers in parallel, each of 2 mill. cu.ft. capacity with provision for the addition of two units of similar capacity.

The exhauster house was designed to accommodate three 230,000 cu.ft. per hour steam driven exhausters, the first installation being a new unit which had to be relied upon until the Thibet Road exhauster was transferred.

From the outlet of the exhausters the gas flow was arranged to proceed in two streams, the first of which passed through a section consisting of new plant of 3 mill. cu.ft. per day capacity, comprising:—

One P. & A. tar extractor.
One washer scrubber.
One Livesey washer.
One complete oxide purification plant.

The second section of 2 mill. cu.ft. capacity consisted of all transferred plant with the exception of one 2 mill. cu.ft. P. & A. tar extractor. The two 1 mill. cu.ft. washer scrubbers were arranged to operate in parallel in conjunction with the transferred Livesey washer and oxide purification plant.

At the outlet of the two sections of purifying plant, the two gas streams were arranged to meet and continue through a new Holmes Dri-gas and naphthalene extraction plant and Connersville station meter, each of 4 mill. cu.ft. per day capacity, and thence into the gasholder of capacity 750,000 cu.ft.

Ample ground area was arranged to accommodate two further sections of wet and dry purification plant, each 2 mill. cu.ft. per day capacity complete with tar extractor, Livesey washer, washer scrubber, purifying boxes, Dri-gas and naphthalene plant and station meter.

The boiler house was arranged in a central position in close proximity to the pump house, exhauster house and purification plant.

The transformer house and adjacent compressor house containing the main switch board was placed close to the gasholder and as near to the main road as possible, thereby reducing to a minimum the length of gas main and expensive inlet power cable.

It will be seen that the long narrow site was admirably suited for an economical layout of plant arranged for coal to enter the Works at the south end and for Gas to leave the Works at the north end.

POWER SUPPLY.

By arranging an electrical drive to the main gas compressors, which would be continually pumping Gas from the new Works to the Thibet Road Holder Station, a very good "power factor" was obtained from the local power company, enabling electric power to be purchased at a calculated rate of $0·025 per horse power, which at an exchange rate of 1s. 3d. to one dollar is equal to 0·375d. per horse power. This figure was less than the calculated cost per brake horse power developed by steam driven generators with fuel at $17.00 (£1 1s. 3d.) per ton, or by gas engine driven generators with gas at $1·05 (1s. 3·75d.) per 1,000 cu.ft. (calculated cost into holder).

It was therefore decided that all machinery should be electrically driven with the exception of exhausters, washer scrubber engines, tar and water pumps, all of which it was calculated would absorb the excess steam from the waste heat boilers.

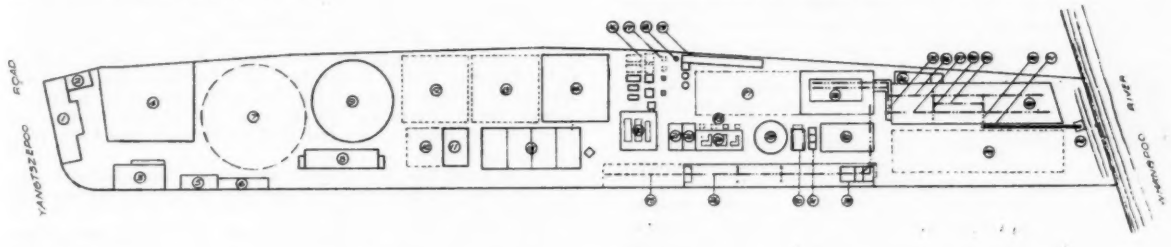
As a safeguard against an interrupted supply of local electric current a gas engine driven alternator was installed to take care of the essential electrically operated machinery, and steam driven compressors were transferred from the old Works to operate as a standby for the main electrically driven compressors, referred to later.

WATER SUPPLY.

The cost of town water for plant use was prohibitive, and the alternatives were artesian well water or Whangpoo River water.

It was eventually decided to instal settling tanks and pressure filters to treat 12,000 gal. per hour of river water for winter use and to sink an artesian well to produce 20,000 gal. per hour of cold water (70° F.) for summer use, one supply acting as a relief for the other.

Whangpoo River water is extremely dirty and during the summer reaches a temperature above 90° F. Centrifugal pumps in duplicate were installed below ground level at



1	Office	12	Future Purifier 2 Million C/ft	23	Condensers	34	Chinese Mess Room
2	Laboratory	13	" " " " "	24	Exhauster House	35	No 7 Conveyor
3	Workshop	14	No 1 " 3 " "	25	Future Telpher Track	36	No 6 "
4	Tar Plant	15	No 2 " 2 " "	26	Telpher Track	37	No 5 "
5	Blacksmith Shop	16	Washer Scrubbers	27	Future Vertical Retort House 6 M Cft	38	No 4 "
6	Benzol Plant	17	Tar Extractor	28	Vertical Retort House 4 Million C/ft	39	No 3 "
7	Future Gas Holder	18	Well	29	Water Gas Holder	40	No 2 "
8	Compressor House	19	Water Setting Tank	30	W G Tar Separator, Oil Tank Below	41	No 1 "
9	Gas Holder 750,000 C/ft	20	Boiler House	31	Water Gas Condenser	42	Coal Store Capacity 5,500 Tons
10	Future Naphthalene & Dri Gas Plant	21	Office	32	Water Gas Plant	43	Future Coal Store 6,500 Tons
11	Naphthalene & Dri Gas Plant	22	Pump House	33	Coke Bunker	44	Avery Coal Weighing Machine

Dotted lines indicate future plant

FIGURE 1.—*Plan of New Yangtszepoo Works; Capacity 4 mill. cu.ft. per day, with Provision for Extensions to Produce 8 mill. cu.ft.*

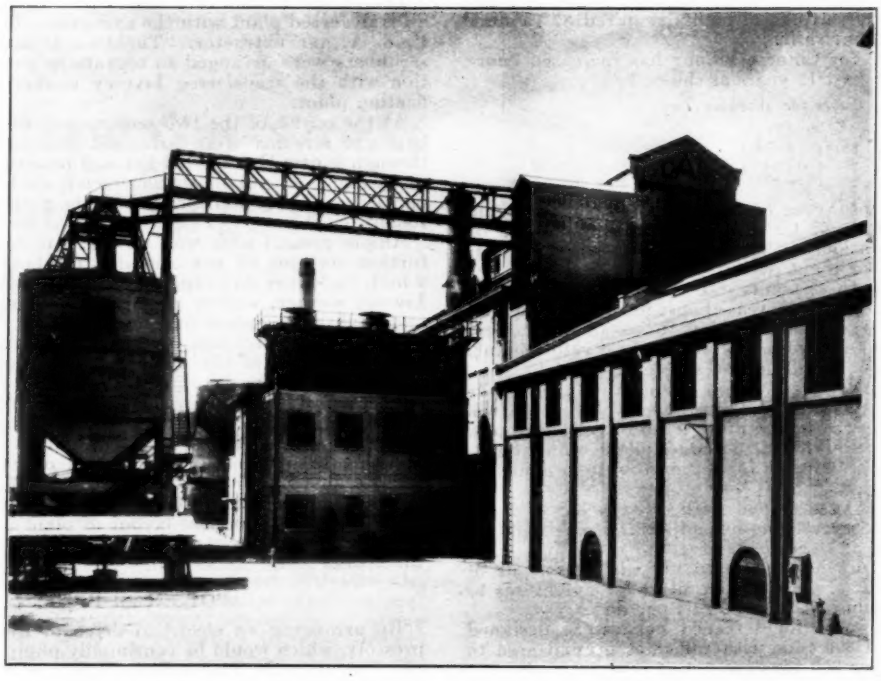


FIGURE 2.—*Coke Bunkers, Relief Holder, Water Gas Plant, Retort House and Coal Store.*

the river wharf and water was pumped direct to a reinforced concrete settling tank, 100 ft. × 10 ft. × 5 ft. deep at the north end sloping to a depth of 10 ft. at the south end. By the addition of a carefully regulated supply of pure aluminium sulphate at the inlet to the settling tank and the correct amount of agitation, the solids in the water form a "floc" and fall to the base of the tank. The semi-clear water was pumped from the opposite end of the settling tank through 8 ft. diameter high pressure sand filters, duplicated, to the overhead storage tank. The final water was perfectly clear and contained about 3·9 deg. temporary hardness and 3·7 deg. permanent hardness. The artesian well (8 in. bore) was sunk to a depth of 650 ft. and the water raised by compressed air at 80 lb. per sq.in. pressure provided by a 50 h.p. compressor. The well water was perfectly clear pure water at an unchanging temperature of 70° F. and contained about 1·3 deg. temporary hardness and 7·2 deg. permanent hardness.

The ultimate cost of river water, including capital charges on the settling and filtering plant, was $0.11 (1·65d.) per 1,000 gal. and the figure for artesian well water was $0.10 (1·5d.) per 1,000 gal., whereas the lowest rate for pure town water was $0.20 (3d.) per 1,000 gal.

FOUNDATIONS FOR PLANT AND BUILDINGS.

The site as purchased was a swamp, the surface of which was 5 ft. below Yangtszepoo Road level and was flooded by the Whangpoo River at high tide; it was reclaimed from the river during the year 1919. Owing to the lack of good filling material the site was filled with refuse during the spring and summer of 1932; consequently all filling material had to be chemically treated to prevent the breeding of swarms of flies and mosquitoes. According to the Shanghai Municipal Council Building Rules the pressure of foundations on the soil must not exceed 1,700 lb. per sq.ft. and even at that load settlement will take place.

In designing the plant foundations the bearing load of the soil was in most cases ignored and was never calculated at a greater load than 300 lb. per sq.ft.: therefore the entire plant and buildings were carried on piled foundations. The bearing capacity of piles driven into Shanghai mud depends on the surface area of the pile, which according to Shanghai building rules can be taken at 225 lb. per sq.ft. skinfriction; but the majority of the plant piled foundations were designed at 200 lb. load per sq.ft. of pile surface.

It is almost impossible to pile down to a rock hard base even at a depth of 120 ft.; therefore the entire load on the pile is taken by the skinfriction of the surface of the pile.

The majority of piles used were either Douglas Fir or Oregon Pine timber; the shorter piles were wedge shaped and the larger piles round. This type of pile is quite satisfactory in Shanghai soil, the natural water saturation level being only 2 to 3 ft. below ground surface. The telpher trestle foundation piles were pre-cast reinforced concrete.

All piles were driven to a set of ½ in. in 12 blows with a 3½ ton hammer through a 3 ft. drop. Upon the completion of pile driving the earth was excavated to the required depth and piles cut to suit. The whole foundation area was then covered with a 3 in. layer of cinder concrete (1 to 6 mixture) to produce a clean, dry surface and facilitate the placing of reinforcing steel.

The top 5 ft. of filling had to be ignored and all reinforced concrete raft foundations were commenced at or below the original surface of the swamp.

GASHOLDER FOUNDATIONS.

The gasholder foundation was designed as a reinforced concrete disc, 112 ft. diameter, stiffened with a ring edge beneath the tank rest blocks, with 24 Oregon Pine piles, 14 in. diameter × 80 ft. 0 in., and 96 wedged piles, 12 in. × 9 in. to 3 in. × 40 ft. 0 in., beneath the ring edge. The main area of the disc was carried on close piling, 527 wedged timber piles, 12 in. × 9 in. to 3 in. × 40 ft. 0 in., spaced at four feet centres both ways were used. The centre post was supported on one 80 ft. 0 in. pile.

The foundations of the many other subsidiary buildings followed closely upon standard practice.

The architecture of all buildings was simple, yet effective and similar throughout the Works.

CARBONIZING PLANT.

The carbonizing plant consists of thirty 80 in. major axis upwardly heated Woodall-Duckham continuous vertical retorts, capable of producing 4 mill. cu.ft. of gas per day.

The plant is arranged with waste heat boilers in duplicate, tar and liquor separator, and facilities for the distribution of liquor through the foul gas collecting mains. A safety relief governor set to operate at five-tenths inch pressure is installed on the foul main and has been of inestimable value.

Apart from the upwardly heated flues, the special feature of the plant is the external battery of producers specially designed to utilize breeze fuel.

The retort house is provided with air conditioning plant in the form of a 30 h.p. Sturtevant blower introducing fresh air to the top floor of the bench through a system of light galvanized iron tubes varying in diameter from 3 ft. 4 in. to 10 in.

HIGH PRESSURE TRANSMISSION TO MAIN GASHOLDER STATION.

The main gasholders, situated on the Thibet Road site, are 6·534 miles from the new works. It was considered that electrically driven compressors in duplicate, each having an output of 200,000 cu.ft. per hour, would cope with the

FIGURE 3.—*Showing, left to right, Telpher, Exhauster House and Pump House with Water Tower above; Boiler House with Purifiers and Gasholder behind; Tar Extractors and Scrubbing Plant; High Pressure Water Filters and Settling Tank.*

output of gas during the next 10 to 12 years, but that the high-pressure pipe line should be arranged to deal with the possible future quantity of 8 mill. cu.ft. per day or 330,000 cu.ft. per hour.

The pipe eventually decided upon was 14 in. diameter spun pipe, in 18 ft. lengths, with Stanton-Wilson joints. Although slightly dearer than socket and spigot spun pipe with lead joints, it was considered preferable owing to the extraordinary amount of movement in the pipe line that can be taken up by the joints.

The condition of the Shanghai soil and the tremendous increase in heavy road traffic is conducive to excessive vibration on all underground pipes. The main was laid during 1933 with a minimum cover of 4 ft. 0 in. wherever possible and was tested to 50 lb. pressure per square inch. The Stanton-Wilson joint has proved highly satisfactory.

MAIN GAS COMPRESSORS.

After a very exhaustive study of various compressors, including horizontal and vertical reciprocating types and centrifugal types, it was found that the fractional control system on the Ingersoll Rand compressors suited the requirements without the adoption of speed control; their efficiency figures were slightly higher than other machines.

STEAM RAISING PLANT.

The steam raising plant consists of waste heat boilers in duplicate, two 30 ft. 0 in. × 9 ft. 0 in. Lancashire boilers, having an evaporation capacity of 10,000 lb. per hour, and one, 28 ft. 0 in. × 7 ft. 0 in., Lancashire boiler having an evaporation capacity of 6,000 lb. per hour. It was essential to install the new 30 ft. 0 in. × 9 ft. 0 in. Lancashire boiler in order to commence gas making; the other two boilers were transferred from the Thibet Road Works.

It was calculated that one waste heat boiler would provide 5,000-6,000 lb. of steam in excess of that required for the operation of the vertical retort bench, and that this would be sufficient to operate the remaining steam driven plant during the summer months and when the water gas plant was not in operation.

The maximum steam requirements during the winter period with the water gas plant in operation and including the quantity of steam required to operate the vertical retort bench was estimated at 14,700 lb. per hour. Therefore, to prepare for any future demand the boiler installation was designed for three 30 ft. 0 in. × 9 ft. 0 in. Lancashire boilers, which would allow for one boiler to be "off for cleaning" while maintaining sufficient capacity to respond to the total demand should all the waste heat boilers be out of action.

WATER GAS PLANT.

The high cost of solar oil prohibits the continued operation of the water gas plant, but it has always been considered essential to maintain a plant to assist in the manufacture of gas during labour strikes, local wars, or a poor coke market.

The plant existing at the Thibet Road Works was erected during 1895 and consisted of two units, each capable of producing 75,000 cu.ft. of 500 B.Th.U. gas per day. By making certain modifications to the plant the makers were able to increase the output of each set to 1,900,000 cu.ft. of 500 B.Th.U. gas per day.

The most important alterations were: the existing generator shells were provided with a new bottom tier of side plates, new blast, gas and steam branches; two new sets of reverse-make apparatus adapted to the back run process were added; the existing carburetters were provided with new gas inlet branches; larger steel conduits connecting carburetters and superheaters and new larger self sealing gas off-take conduits from superheaters to washers were provided; two new and larger washers of oval design and one new high duty multipass horizontal tube condenser were installed, and new valves throughout; in addition, two new and more powerful steam turbine blowing plants were supplied.

The manufactured water gas passes from the condensers into a 50,000 cu.ft. spiral guided relief holder and from the latter through a Connersville meter to the inlet of the main coal gas exhausters.

TAR PRODUCTS SECTION.

The tar plant is arranged at the north end of the site near the main road. It consists of three 12-ton pot stills and one 15-ton per day T.I.C. plant, pitch beds and storage tanks for various refined tars, and tanks, of 100,000 gal. capacity, for different grades of tar oils.

Most of the tar produced is worked up into a "flux" and used in a "cold mix" process, producing an excellent material for road surfacing. The material does not "bleed" during the intensely hot summer or crack during the extremely cold winter. The manufacture of this "flux" requires bitumen melting tanks, mixing and storage tanks, all of which are provided.

The tar oils produced are marketed as naphtha, disinfectants and wood preservatives; and stills, mixing and storage tanks have been installed to cope with such manufacture.

Ample ground space has been arranged for the installation of a benzol extraction and rectification plant and monochlor benzene manufacturing plant, which will be in operation early in 1936.

The new works plant was put into operation on the 8th February and the old Thibet Road site shut down on the 13th March, 1934. A portion of the Thibet Road site, east of Thibet Road, is still retained and contains two 1-mill. cu.ft. and one 2-mill. cu.ft. capacity spiral guided gasholders, governor house, Holmes Connersville high pressure district boosters, head office, distribution and transport departments, and district workshops where all meters and district appliances are made or repaired.

COST OF WORKS.

Table 1 shows the cost of the new Works calculated at exchange rate of 1s. 3d. to one Shanghai dollar.

TABLE 1.—*Analysed Cost of New Works, Shanghai.*

—	—	Percentage of Total Cost New Works.
1	2	3
	£ s. d.	
Cost of the new site	88,994 9 9	25·38
Total cost of imported plant c.i.f. Shanghai	135,323 3 2	38·61
Total sum paid for Customs import duty on imported plant	17,606 6 7	5·02
Value of plant transferred from the old Works	5,119 1 8	1·46
Total cost of plant and materials purchased locally	30,319 7 4	8·65
Cost of plant foundations	22,847 15 8	6·52
Cost of buildings and their foundations	23,322 14 11	6·65
Cost of transportation, insurance, storage, and other miscellaneous expenses	5,157 11 11	1·47
Sundry expenses	4,306 16 8	1·23
Total cost of native labour and foreign supervision	17,531 14 7	5·00
Total cost of new Works	£350,529 2 3	99·99

CARBONIZING RESULTS DURING SIX MONTHS' WORKING, 30TH JUNE TO 31ST DECEMBER, 1934.

Table 2 shows the carbonizing results obtained during the six months period. The Gas made consisted of coal gas from steamed vertical retorts plus 1 to 3 per cent. of air for purification purposes plus approximately 12 per cent. producer gas admitted in order to reduce the calorific value of the gas to 440 B.Th.U. per cu.ft.

Coke discharged from retorts and not required for plant use is sold immediately to a Chinese contractor who controls the retail market. Such coke is sampled daily and tested for moisture, volatile matter and ash content, and the average of such tests is given in Table 3.

The quantity of coke and breeze used in producers appears to be exceptionally high, being 5·22 cwt. wet, or 4·32 cwt. or 21·6 per cent. of dry, coke per ton of coal carbonized. This is due to maintaining the entire bench of retorts continually under heat with a view to extending the life of the bench and the number of working days between resetting. Although it is not possible to foretell accurately to what extent the retort working days between resets will be increased, the poor condition of the local coke market coupled with the high cost of resetting in Shanghai may eventually prove this method of operating to be a financial advantage.

TABLE 2.—*Carbonizing Results per Ton of Coal Carbonized over Six Months' Period ending 31st December, 1934.*

1	2
Coa carbonized (average moisture content 3·11 per cent.)	21,495·85 tons
Gas made corrected to 60° F. and 30 in. Hg.	440,714,650 cu.ft.
Gas made per ton coal carbonized corrected to 60° F. and 30 in. Hg.	20,550 ,,
Average calorific value per cubic foot	438·0 B.Th.U.
Average therms per ton coal carbonized.	90·0
Tar produced (water content 3·25 per cent.)	17·46 gal.
Total coke and breeze per ton coal carbonized from retort dischargers (average moisture content 17·32 per cent.)	13·40 cwt.
Coke and breeze used as producer fuel after deducting coke recovered from ashes (average moisture content 17·2 per cent) (30 per cent. retorts under scurfing conditions)	5·22 ,,
Coke and breeze sold to the public (average moisture content 17·32 per cent.)	7·32 ,,
Coke and breeze used on works, &c. (average moisture content 17·32 per cent)	0·86 ,,

TABLE 3.—*Average Analysis of Coke Produced.*

Moisture.	Dry Basis.		
	Ash.	Volatile Matter.	Fixed Carbon.
1	2	3	4
Per Cent. 17·32	Per Cent. 23·5	Per Cent. 3·5	Per Cent. 73·0

The average number of retorts charged with coal during the six months' period was 20·6 per day, leaving an average number of 9·4 retorts under scurfing conditions. After making allowances for scurfing retorts, the theoretical fuel consumption is calculated to 17·5 per cent. dry coke per ton of coal carbonized which is less than the guaranteed figure of 18·25 per cent.

The addition of approximately 12 per cent. of producer gas to dilute the steamed coal gas also accounts for approximately 0·43 cwt. of coke fuel per ton of coal carbonized.

The quantity of coke and breeze discharged from the retorts, containing 5 per cent. moisture and excluding that required for producer fuel, equals 7·10 cwt. per ton compared with the guaranteed figure of 6·75 cwt. per ton.

Table 4 gives the cost of gas into main gasholders compared with equivalent cost of producing a similar quantity of gas from the old Thibet Road plant which operated with machine charged horizontal retort plant and the normal equipment of purification plant.

TABLE 4.—*Comparative Costs of Gas Made into Thibet Road Gasholders.*

ONE CHINESE DOLLAR EQUALS APPROXIMATELY 1S. 3D.

NEW YANGTSZEPOO WORKS. Actual Costs for Six Months, 30th June—31st December, 1934.			OLD THIBET ROAD WORKS. Hypothetical Costs based on Results obtained during similar period, 1933		
1			2		
GAS MADE— 440,714,650 cu.ft. at 20,550 cu.ft. per ton, C.V. 440 B.Th.U. per cu.ft.			GAS MADE— 440,714,650 cu.ft. at 15,500 cu.ft. per ton, C.V. 440 B.Th.U. per cu ft.		
COAL CARBONIZED—	$	$	COAL CARBONIZED—	$	$
Tons 21,495·85 at $15.25		327,811.71	Tons 28,433 at $15.25		433,603.25
Power supply	10,617.77		Power supply	3,623.27	
Water ,,	1,418.19		Water ,,	630.13	
Oil and sundries	7 379.62		Oil and sundries.	2,198.54	
Purification materials	2,404.53		Purification materials	3,132.08	
		21,820.11			9,584.02
LABOUR—			LABOUR—		
Foreign	43,920.00		Foreign	38,641.66	
Chinese	27,420.00		Chinese	31,550.65	
		71,340.00			70.192.31
		420,971.82			513.379.58
LESS RESIDUALS FOR SALE—			LESS RESIDUALS FOR SALE—		
Coke at 7.32 cwt. per ton. Tons 7,867·5 at $10.00		78,675.00	Coke at 7·63 cwt. per ton. Tons 10,847 at $10.00		108,470.00
Tar at 17·46 gal. per ton. Gal. 375,317 at $0.30		112,595.10	Tar at 12·8 gal. per ton. Gal. 363,942 at $0.30		109,182.60
NET COST MANUFACTURE		$229,701.72	NET COST MANUFACTURE		$295,726.98
Cost per 1,000 cu.ft. made		$0.521	Cost per 1,000 cu.ft. made		$0.671

Reduction in manufacturing cost per 1,000 cu.ft. gas made = $0.15 = 22·35 per cent.

The Society of British Gas Industries

Annual Meeting and Dinner, May 13, 1936.

The Annual Meeting of the Society of British Gas Industries was held at the May Fair Hotel, London, W. 1, on Wednesday, May 13, under the Chairmanship, in the absence of Sir John Cadman, G.C.M.G., D.Sc., through indisposition, of Mr. D. M. HENSHAW, Chairman of the Council.

The CHAIRMAN stated that at very short notice Sir John Cadman had had to go into a nursing home, which made it impossible for him to be with them on that occasion. It was for this reason that Mr. Henshaw was presiding over that meeting.

The Minutes of the last Annual Meeting having been confirmed and signed, the Council's Report for 1935-36 was presented by the Chairman of the Council, and taken as read.

REPORT OF THE COUNCIL FOR 1935-6.

The Council begs to present to the Members its Thirty-first Annual Report on the work of the Society.

President.—It is with the greatest pleasure that the Council is able to announce that the Marquess of Londonderry has very kindly consented to succeed Sir John Cadman as President of the Society.

The Society's Silver Jubilee.—The year has marked the completion of thirty years of the Society's work. The occasion was celebrated by a Luncheon on Nov. 7, at which the Society's Founder and first Chairman, Mr. Charles Clare, presided and was accorded a most spontaneous and hearty welcome by a distinguished gathering of Past-Chairmen and Members of the Society.

British Gas Federation.—The year under review has witnessed the completion of the first year's work of the British Gas Federation.

The Second Annual Dinner of the Federation was held on Dec. 11, with Lord Macmillan, the retiring President, in the Chair. It is a matter of particular pleasure to the Society that one of their most distinguished Past-Presidents, the Earl of Dudley, should have now assumed office as President of the British Gas Federation. In this capacity he presided recently at a meeting of the Federation held in connection with the Gas Industries Exhibit at the Birmingham Section of the British Industries Fair.

The Council took its part in the formation of the Federation, and it is therefore particularly gratifying to be able to report already the increase in the prestige of the Gas Industry which has been brought about by the co-operation of all branches of the Industry through the Federation. It was also a matter of satisfaction to the Council that their Chairman should have had the pleasure recently to propose the re-election of Sir David Milne-Watson as Chairman of the Council of the Federation. To Sir David is very largely due the credit for the formation of the Federation, and to his guidance during its first year the singularly smooth manner in which its proceedings have been conducted.

For the first time the Industry has an organization through which it can speak with one voice on all national problems. Moreover, the Federation, without interfering with the individual activities of the organizations of which it is composed, affords an opportunity for a frank exchange of views on matters of common interest; for a much closer co-ordination of the work of the Industry's national organizations; and for the initiation of projects which can be undertaken for the general good of the Industry.

The Council of the Society fully appreciates that the interests of its Members are synonymous with those of the whole Industry, and is confident that these interests can be served in no better way than by co-operating to the fullest possible extent in the work of the British Gas Federation.

Exhibitions Committee, British Gas Federation.—One of the first acts of the British Gas Federation was to set up an Exhibitions Committee, on which the Society is strongly represented. The Society's Members are called upon to support a large number of Exhibitions, and the activities of this Committee are already proving of advantage, not only to the Society's Members, but to the Industry as a whole. An important further result is that the attention of all concerned is tending to become more clearly focused on the extent of the contribution which the Society's Members make towards the general propaganda work of the Industry through participation in a wide range of Exhibitions.

British Industries Fair, 1936.

British Industries Fair, Birmingham Section, 1936—Gas Industries Section.—It was at the pressing request of the Gas Industry as a whole that the Society undertook to support the Gas Industries Section at the Birmingham Section of the British Industries Fair in February.

As the result of concerted effort, a compact block in a central space of the Exhibition was secured. A most attractive range of apparatus, appliances, and accessories was exhibited by the Society's Members, and the general excellence of the exhibit as a whole was the subject of favourable comment on all sides. In particular, mention might be made of the pleasing effect produced by the prevalence of the open type of stand of which the Gas Industry was the pioneer. The arrangements for the Exhibition were made under the guidance of the Gas Industries Section Committee, on which each group of the Society was represented, and over which the Chairman of the Council of the Society presided.

Two features of the Exhibition, the Central Information Bureau and the Industrial Gas Exhibit, resulted from co-operation between the Society and the British Commercial Gas Association, associated with the latter being the Industrial Centres and their Technical Sub-Committee. The Society, with the assistance of certain Members of the Heavy Sections, shared equally with the Association in the cost of these two exhibits, and, in addition, Members of the Society loaned apparatus which was shown on the stand devoted to the industrial uses of gas.

The British Gas Federation held a Joint Gas Conference during the second week of the Fair. Lord Dudley was in the Chair, and after an official welcome by the Lord Mayor of Birmingham and the President of the Birmingham Chamber of Commerce, delivered a most able Presidential Address on the opening day. On the second day an Address was given by Mr. Dean Chandler on "The Uses of Gas in Trade and Industry," and was followed by an interesting discussion. An Official Gas Industry Luncheon, and a Luncheon by invitation of the Birmingham Chamber of Commerce and the Fair Management Committee took place on successive days. Mr. H. C. Smith presided over the Committee responsible for the arrangements for the Conference.

The Society is very much indebted to the Chairman and General Manager of the Birmingham Corporation Gas Department, for their co-operation and support, and to Mr. W. L. S. Spinks for his admirable services as Honorary Secretary.

Institution of Gas Engineers—Joint Lighting Committee.—The Society's representatives on the Joint Lighting Committee have assisted in the compilation of the fourth Draft Proposed British Standard Specification for Low Pressure Gas Mantles, which shortly comes up for revision. The Joint Committee has also under consideration the suggested improvement of the efficiency of Gas Lighting Burners, Mantles and Switches, and a Sub-Committee has been appointed to meet Members of Section 7 of the Society to discuss the matter.

The issue of the interim report of the Departmental Committee on Street Lighting set up by the Ministry of Transport has necessitated the preparation of a report regarding the revision of the British Standard Specification for Street Lighting. The Society's representatives have assisted in the compilation of the report.

Support for British Standards Institution.

British Standards Institution.—In order that the work of the Gas Industry Section can be put on a satisfactory, and, at the same time, independent basis, the Gas Industry Committee have given consideration to the collection of the necessary funds for its proper support. The estimated annual expenditure of the Section is approximately £1,500, towards which it is suggested the Industry should contribute approximately £1,000. The contributions from the national organizations are being put on a basis comparable with those of organizations in other industries, and in addition individual gas undertakings and manufacturers have been invited to become contributing members of the Section.

The Society is maintaining its close co-operation with the

Institution, and is represented on the following Committees, Sub-Committees, and Panels:

Gas Industry Committee.
Gas Industry Advisory Panel.
Flexible Metallic Tubing and Connections Sub-Committee.
Gas Industry Terms Committee.
Gas Industry Terms Editing Committee.
Solid Fuel Industry Committee.
Methods for the Evaluation of Efficiency and Performance of Plant in which Gas is used (Technical Committee).
Standardization of Flue Pipes and Fittings (Technical Committee).
Illumination Industry Committee.
Lighting Fittings (Technical Committee).
Neck Dimensions Sub-Committee.
Diffusing Materials Sub-Committee.
Bitumen and Asphalt Sub-Committee.
Street Lighting (Technical Committee).
Hydro-Extractors Committee.
Fans (Technical Committee).
Steel Strip (Technical Committee).
Water Fittings (Technical Committee).
Furnaces and Ovens (Technical Committee).
Gas Meter Unions (Technical Committee).

Women's Gas Council.—The Women's Gas Council, which was brought into being during the year, is making good progress. A number of branch organizations are already engaged in active work with a growing membership roll. Further branches are in course of formation. The Women's Gas Council has affiliated with a number of other national organizations, and co-operation is being established in many important directions. The Society has two representatives on the Executive Committee of the Council.

International Commission on Illumination.—The Society was represented by three official delegates at the Ninth Plenary Session of the International Commission on Illumination held in Germany in July. A report to the Society by one of the delegates was published in the Autumn *Bulletin*.

Junior Gas Associations—Award of Silver Medals.—The Council, as in previous years, has awarded Silver Medals to each of the Junior Gas Associations for the best Paper adjudged to have been presented during the year by their Members at a General Meeting. The results were announced in the Technical Press.

City and Guilds of London Institute.—The Council has again awarded prizes to the first and second candidates in the Minor Examinations in Gas-Works Practice and Gas Supply Practice, and the Final Examination in Gas Fitting at the City and Guilds of London Institute. It is gratifying to know that the Council's action is greatly appreciated.

French Import Quotas.—The issue of Quota Certificates in respect of certain gas apparatus for importation into France, in accordance with the regulations of the French Government, is still being conducted by the Society. The Society is indebted to the Board of Trade and the Federation of British Industries for their assistance in connection with the problems which arise from time to time in the administration of these quotas.

The Society was able to play some part in securing a quota for lampware, which was a valuable concession to interested Members.

Special Fund.—The Council is gratified at the increased support of this Fund and hopes all Members will see their way to become regular subscribers.

Membership.—The membership of the Society has made very notable strides during the past year, 24 new firms having joined the Society during the period under review. The Entrance Fee is at present waived, but the Council may have to reconsider this in the near future.

The Industrial Load and Section 9.

Industrial Gas.—The leaders of the national organizations, recognizing the great opportunity which modern manufacturing processes offer for the consumption of gas, have set up a business-like scheme for the practical application of research in this field by the creation of the Industrial Centres. The Council realizes the obligation of the Society, as the organization representative of the manufacturers, to assist this development in every possible way, and to provide a basis on which to work, the Council will recommend to the Annual Meeting that Section 9 should be called the "Industrial Gas Equipment" Section. It is hoped that firms interested in industrial gas equipment will realize the advantage to them of membership of this Section of the Society. The Council is confident that this movement will be a conspicuous and successful example of co-operation between the manufacturers and the supply side of the Industry.

Two outstanding Industrial Gas Exhibits were staged during the year, one at the Shipping and Machinery Exhibition at Olympia in September, and the other at the British Industries Fair at Birmingham. In both cases there was the closest co-operation between the two sides of the Industry, and many Members of the Society assisted with the loan of apparatus.

General.—The Society is very much indebted to the President, Sir John Cadman, for the very able and valuable Address he presented at the Annual Meeting in May, entitled "The Future of Gas."

An Address was given by Mr. D. M. Henshaw, Chairman of the Council, at the Autumn Meeting, entitled "Specialization in the Gas Industry—30 years of Progress."

The Contractors and Manufacturers are proud of the contributions which they have made to the development of the Gas Industry all through its history. The Council is anxious that this pride of achievement should find its focus in the Society, which has far greater opportunities now than ever before of representing to the whole Industry both the achievements and the views of its Members.

The Council, on its side, is glad to be able to report that not only are the steps which it is taking to strengthen the Society proving effective, but that during the year there have been many gratifying examples of the benefits to be derived from the closer co-operation with the other side of the Industry, which a new state of affairs has made possible.

Internally the Council is able to report both an increase in membership of the Society, which entirely eclipses the results of any previous year's working, and also a striking increase in the interest which is being taken by its Members in the Society's activities. This is full of promise for the future, not only of those interests which the Society represents, but also of the Gas Industry as a whole, for a united Industry clearly offers scope for progress to an extent which would be impossible under any other circumstances.

Externally, the period under review has been devoted primarily to the creation of the necessary machinery to give effect to the desire for closer co-operation and co-ordination. In the immediate future lies ahead of the Council the task of assisting in this development and of doing its utmost to promote those objects which it is hoped to achieve. This report shows that appreciable progress has already been made of a nature that augurs well for the future.

In concluding its report, therefore, the Council wishes to thank the Members of the Society for their support during the year, and in doing so desires to stress that it is only by the continuous and increased support of the Members that the Society can play that part in the affairs of the Industry which both circumstances and the vital interests of the Society's Members demand of it.

On behalf of the Council,
D. M. HENSHAW,
Chairman.

April 16, 1936.

In moving the adoption of the Report, the CHAIRMAN observed that the activities of the Society had been well maintained during the past year. There had been an increase of 22 in their membership. This was the first year of the British Gas Federation, of which their Society was a member, and he was glad to say that Sir David Milne-Watson had consented to be the Chairman of the Council of that Federation for another year. The Report mentioned the Society's re-entrance to the Birmingham Section of the British Industries Fair, and their activities there had largely increased by reason of the Industrial Gas Section. This co-operative effort, said Mr. Henshaw, would be of benefit not only to the Society but to the Industry as a whole.

Mr. F. B. RICHARDS, in seconding the adoption of the Report, also referred to the fact of the Society being a member of the British Gas Federation, and thought that this step would open up very considerable possibilities to them. But he considered it important that they should not try to go too fast; they must proceed gradually and acquire the confidence of their other partners in the Federation. He himself would shortly have to assume the position of Chairman of the Council, and he would like to say that during his period of office it would be his constant aim to carry on the work of the Society in the way it should go.

The Report was unanimously adopted.

Mr. F. J. GOULD proposed the adoption of the accounts in the absence of Dr. E. W. Smith, the Hon. Treasurer. In doing so he said how much they missed Dr. Smith, and they would all welcome him back. He also referred to the able management of Mr. Burt and stated that the Society had prospered during the year under review.

The proposition was seconded by Mr. E. J. DAVISON and unanimously agreed to.

An Alteration of Rule.

The CHAIRMAN said that owing to the rapid growth in the use of gas industrially and the number of concerns whose interests were almost entirely bound up in the industrial side, the Council felt that they should have means of identification and of meeting together to discuss problems of common interest as was the case in other Sections of the Society. It was therefore proposed that they should re-name Section 9 "Industrial Gas Equipment Section." They were sure that many firms, both old and those who had joined the Section recently, would support the Industry in their efforts to obtain this load which had made such progress during the past year or two. He thought they would agree that this move was in the right direction, and he therefore proposed that Section 9 be re-named as he had stated.

The resolution was seconded by Mr. F. B. RICHARDS and unanimously agreed to.

The MANAGER AND SECRETARY (Mr. M. W. Burt) then read out the names of those members who had been elected

to serve on the Council as representatives of the various Sections. These were as follows:

Mr. Ernest West	Section	I.
Mr. John Drake	,,	II.
Mr. Richard Miles	,,	III.
Mr. Leonard Hartley	,,	IV.
Mr. C. G. Langford	,,	V.
Mr. Cyril G. Davis	,,	VI.
Mr. Philip H. Sugg	,,	VII.
Mr. George Ewart	,,	VIII.
Mr. John Orme	,,	IX.
Mr. T. Allen	,,	X.
Mr. F. H. Wilkinson	,,	XI.
Mr. T. Alborn Clapham	,,	XII.
Alderman G. Clark, J.P.	,,	XIII.
Mr. A. J. B. Atkinson	,,	XIV.
Mr. D. Macartney-Filgate	,,	XV.

The New Chairman and Vice-Chairman.

Alderman G. CLARK thereafter said that it was a privilege to move that Mr. F. B. Richards be elected Chairman of the Council and Mr. R. J. Rogers Vice-Chairman for the coming year. Mr. Richards had won the confidence of all the members of the Council who had worked with him during the past year. He welcomed his election to the Chairmanship because he had had the pleasure of knowing him for many years; he appreciated his unassuming, quiet, yet forceful business methods, and he knew that he would make a competent Chairman. He had originally joined Sir Arthur Duckham and a few others in a concern which had now become known the world over, and Mr. Richards

THE NEW CHAIRMAN.

F. B. RICHARDS, M.B.E., M.Inst.C.E., M.I.Mech.E.

Mr. Francis B. Richards was apprenticed to Wm. White & Sons, of Cowes, and was also a pupil under Lieut.-Col. H. W. Woodall, Engineer and General Manager of the Bournemouth Gas and Water Company. He subsequently became Assistant to the late Sir Arthur Duckham in connection with the design, construction, and operation of the Woodall-Duckham system of continuous vertical retorts. During the war Mr. Richards was Assistant Superintendent of the Government Rolling Mills, Woolston, Hants. In 1923 he was appointed a Director of the Woodall-Duckham Companies, Joint Managing Director in 1930, and Chairman (in succession to Sir Arthur Duckham) in 1932.

was now Chairman of that great undertaking. He was sure that a man whose character had forced him ahead in that way must have a great deal in him. He was a man they could depend upon, and he was quite sure that whatever good work had been done by their present Chairman and his predecessors would not be lessened by Mr. Richards. He was delighted that he had come forward to take this position because he knew he would carry out his duties well.

Mr. Rogers, went on Alderman Clark, was a newcomer to that side of the Industry, though they had known him on the other side at Birmingham for many years. Those who had worked with him in Birmingham knew how much he had done for the Industry; he would make a worthy Vice-Chairman, and, in another year, a Chairman of the Society.

The resolution was seconded by Mr. H. E. BENNET and carried unanimously.

Mr. RICHARDS, in acknowledging his election, wished he could merit the very kind things which Alderman Clark had said. He would do his best during his period of office to follow the lead given not only by the gentleman who then occupied the Chair but also his predecessors. He would do his best to enhance the prestige and good name of their Society.

Mr. ROGERS also returned thanks for his election, saying that he would do his utmost to carry out the duties which would devolve upon him and do his best for the interests of the members of the Society.

On the proposition of Mr. A. J. WEST, seconded by Mr. L. HARTLEY, the following Officers and Elective Members were appointed:

Hon. Treasurer.—Mr. F. J. Gould.
Hon. Secretary.—Col. O. B. F. Planck.
Elective Members—Mr. D. M. Henshaw and Dr. E. W. Smith
Re-Elected Elective Members.—Messrs. H. E. Bennet, H. M. Thornton, and D. W. Turner.

It was proposed by Mr. H. E. BENNET, seconded by Mr. C. G. LANGFORD, and unanimously agreed, that the Society's Auditors (Messrs. Cash, Stone, & Co.) be reappointed for the ensuing year.

Mr. F. WEST proposed a hearty vote of thanks to the Council and Officers of the Society for their work during the past year. When one looked through the Annual Report, he remarked, one realized that there had been a marked advance in the activities of the Society during the twelve months, and he was sure that all the members of the Society were very grateful to those on the Council for the work they had put in during that period. He could assure them, as a past member of the Council, that the real work of the Council was not portrayed in the brief notice which constituted their Report. Their deliberations and regular meetings entailed a tremendous amount of work, and the members very much appreciated the time they gave to the Society's welfare.

Mr. A. COMLEY seconded the vote of thanks, which was heartily accorded.

The CHAIRMAN, in acknowledgment, said that it had been a pleasure to carry on the work, and so far as he himself was concerned he had derived much satisfaction from feeling that progress had been made, that they had the support of the members of the Society as a whole, and that the various enterprises embarked upon and work carried out had met with the general approval which was essential to every governing body which wished to make progress.

The S.B.G.I. Silver Medals.

The Society's Silver Medals for what had been adjudged the best Papers presented before the various Junior Gas Associations during the past year were then awarded by the Chairman as follows:

London and Southern District Junior Gas Association.
P. F. SCARTH . . . . . Presented Feb. 15, 1935
"Sales and the Basis of Charge."

Midland Junior Gas Association.
W. L. HOWE . . . . . Presented Jan. 3, 1935
"Some Results Obtained with Gas-Fired Central Heating Boilers."

Yorkshire Junior Gas Association.
H. A. FELLS . . . . . Presented April 13, 1935
"Combustion."

Manchester and District Junior Gas Association.
W. HODKINSON . . . . . Presented Feb. 6, 1935
"Benzole Recovery and the Production of Motor Benzole."

Wales and Monmouthshire Junior Gas Association.
J. H. CANNING, JNR. . . . . Presented Mar. 16, 1935
"Roads and Road Tar."

Western Junior Gas Association.
J. W. DENTON . . . . . Presented Dec. 14, 1935
"Distribution."

Scottish Junior Gas Association (Western District).
J. BATEMAN . . . . . Presented Dec. 8, 1934
"Results with Breeze Burning Producers."

The New President.

The CHAIRMAN stated that their new President, Lord Londonderry was unfortunately not able to be there that day for his induction; but as this was only a matter of formality, they had explained to him that his duties in effect commenced with the Autumn General Meeting. Lord Londonderry had asked him to apologize for his absence on this occasion.

Sir John Cadman would in the normal way have presented his Presidential Address (which was published in last week's "JOURNAL") at this stage of the proceedings. In his absence, however, Dr. A. E. Dunstan, a member of Sir John's staff, kindly consented to deputize for him, and proceeded to give a most interesting survey of the Iran and Iraq oilfields and the great pipeline which brings the crude product to the refineries on the coast. He also

touched upon the production of oil in this country and referred to the future possibilities in this connection. His remarks were illustrated by lantern slides, which gave the members a vivid picture of the difficulties connected with oil production on a large scale and how the great undertaking with which Dr. Dunstan was concerned had overcome those difficulties.

A very hearty vote of thanks was accorded to Dr. Dunstan at the conclusion of his Address on the proposition of the CHAIRMAN, seconded by Mr. WALLER, who expressed the Society's hope that Sir John Cadman would make a speedy recovery from his illness.

Dr. DUNSTAN duly acknowledged the vote of thanks, and the proceedings then terminated.

The Annual Dinner

The Annual Dinner was held at the May Fair Hotel, London, on May 13. There was a company of nearly 250, and the Chair was taken by Sir David Milne-Watson (a Past-President of the Society) in the regretted absence, through illness, of the President, Sir John Cadman. The guest of honour was the Rt. Hon. Sir Robert Horne, G.B.E., K.C., M.P.

Regrets for inability to be present were received, among others, from Sir John Cadman (President), Lord Londonderry (President-Elect), Sir Francis Goodenough, C.B.E., Mr. H. Stanley Taylor, Dr. E. F. Armstrong, Mr. Charles Clare, Dr. E. W. Smith, C.B.E., Mr. W. E. Price, Mr. J. W. Whimster, Mr. D. H. Helps, and Mr. S. Henshaw.

After the toast of "His Majesty the King" had been honoured,

Sir ROBERT HORNE proposed "The Society of British Gas Industries" and coupled with the toast the name of Mr. F. J. West (a Past-Chairman of the Society). Sir Robert said that, although it was an unhappy accident which had deprived them of the presence of their President, nevertheless he personally was very happy to be present to propose this toast. He had eaten a very good dinner in very pleasant company, a dinner which he assumed, under the careful direction of the Chairman, must have been cooked in an enamelled gas cooker with automatic control and fed by a self-lighting arrangement—[laughter]—which, according to the advertisements, made life happy for all women domestically inclined in this world. He was, moreover, particularly pleased at being present under the auspices of his old friend Sir David Milne-Watson. He generally met Sir David at gatherings of Scotsmen in London where they were accustomed to lament that they had ever left their native land—[loud laughter]—and the way Scotsmen suffered for the good of the world nobody could tell. [Renewed laughter.] Sometimes they were received with the credit and support to which they were entitled but sometimes with an opprobrium which they had never deserved! However, they were content to suffer, feeling that they were acting in a good cause. [Laughter.]

Sir John Cadman was unable to be present not because of an oil sanction, but because of the doctor's sanction. During the afternoon they had listened to an Address on behalf of Sir John in connection with the oil industry and he was glad to recognize a complete absence of jealousy in the Society of British Gas Industries. The Gas Industry might have thought that oil was one of their chief competitors but at any rate they had been, as he thought wisely, guided to appoint a man like Sir John Cadman as President this year, and he had no doubt they had all been greatly enlightened by the Address which had been given on his behalf. They had also, it seemed to him, very kindly welcomed another competitor in the person of a Member of Parliament. [Laughter.] It was probable that the product of the House of Commons very seldom illumined, but it very often engendered heat, and heat was one characteristic in common with the great work which the Gas Industry was doing. He gathered that the Society had had a most successful year and that there had been a constant expansion not only of the membership, but also of the great organizations which were associated with the Gas Industry. One realized as a common citizen that there was a research movement in the Gas Industry to-day which was an excellent example to many other great industries. [Hear, hear.] He remembered the time when people said the Industry was at an end, when people thought that everybody would cease to use gas and begin to use electricity both for the purposes of light and heat and power. But what was the fact to-day? Instead of the Industry being even degenerate or enfeebled in any degree, it had been advancing in recent years by leaps and bounds, and figures showed there was a progressive movement throughout the whole of it. During the past 10 years there had been an addition of something like 2 million consumers, and at the present time no fewer than 11 million householders used gas in this country, which, in fact, represented practically the whole population. Moreover, the production of gas during the last 10 years had increased by some 38,000 million cu.ft. per annum, and these figures were steadily increasing.

Research and Progress.

Looking at these facts, continued Sir Robert, he asked himself what had been the foundation of all this progress? On many occasions in this country people talked of conditions of depression or situations which it was impossible to get over, and prospects for the future which looked entirely dark. Sometimes people were to be found sitting down with folded arms just anticipating the evil day and preparing themselves for it. The Gas Industry could very well have taken that attitude many years ago, but it had been saved from such a result by what seemed to him to be the resources and the imagination, and the invention and courage, of the people who had guided it. They had always attempted to find some new uses for their product, and the research departments which had been set up within the Industry had demonstrated to a great many other industries what research could do in creating a progressive advance such as was to be seen in the Gas Industry to-day. They had not only provided the kind of thing the public wanted, but had also, by a certain amount of subtle psychology—and Sir David Milne-Watson was as well equipped with that as anybody he knew—[loud laughter]—succeeded in making the public want what the Industry was able to produce, and that, after all, was a much greater achievement.

In that way they had made life much more easy and comfortable for a vast number of people from the domestic point of view, and at the same time they had made a great advance in the supply of heat and power for industry. That, he felt, was one of the portents of the present time. This latter was a field in which oil might be a very serious competitor, and indeed it was at the present time, but the Gas Industry was holding its own and was refusing to accept any position of surrender. It seemed to him that people who were wise would take precautions and would not content themselves with depending upon a supply of power obtained from a Grid, great sections of which might be seriously interfered with, say, during some crisis in the country, but they would make themselves secure by having an equipment of gas engines which at least would enable them to carry on while the other forces were not available. That was one of the things which it seemed to him was very likely to be developed in the immediate future. An enthusiastic friend of his had informed him that a great development in the future would be motor cars which would be run not upon oil or upon petrol, but on cylinders of gas. He hoped, continued Sir Robert, that he was not painting too rosy a picture, but at least it was certain that if the developments which were anticipated at the present time in business throughout the country were realized, there was no cause for any anxiety on the part of anybody who was engaged in the Gas Industry. [Applause.]

There were certain elements, he would not say of anxiety, but elements which engendered watchfulness on the part of some of them. Legislation was being introduced in connection with the coal industry upon which he believed that everyone in the Gas Industry would have to keep a careful eye. There were measures before Parliament at the present time which might prove very hostile to their interests, and it behoved everybody to try and bring such influence as they possessed to bear upon those who were managing that legislation in order to prevent things happening which would be inimical to the interests of the whole of the citizens of the country.

The Country Dependent on the Gas Industry.

Continuing, Sir Robert Horne remarked that he did not consider it an exaggeration to say that the whole fate of this country depended upon the Gas Industry. Coal was the only indigenous asset we possessed in this country, and he did not think many people had considered what would be the effect on this country if suddenly the whole of our coal measures were destroyed, or if something took place by which they were rendered completely valueless. In his view this country would then become derelict, or at any rate it would be reduced to the miserable proportions of a small country maintaining a very small population. In order to get the best advantage from the use of our coal, in order to make the best of that asset, we must treat it economically and there was only one industry which did in fact treat coal economically, and that was the Gas Industry. [Applause.] What the future might unfold he was not prepared to speculate upon. Everybody was delighted to see erected at Billingham that great enterprise for producing oil from coal through hydrogenation, and he was very hopeful that similar plants would be erected elsewhere in this country. Apart from that, there was another side to the economical use of coal which did not consist entirely in the production of oil. He might be somewhat prejudiced but he had always looked with some hope to the prospect of producing not merely a certain modicum of oil, but also a fuel residue which would burn and give heat and glow in a grate after the contaminating

elements, which at present were evaporated to the air, had been abstracted. He could see a London largely cleared of its immense pall of smoke if such a fuel could be produced economically. As most of them knew, New York had been greatly helped as far as health and light was concerned by the fact that there was a strict regulation forbidding the burning of bituminous coal in open grates, and if we could succeed in producing economically a fuel residue—he would not say coke because coke took many forms—which would keep the air clear, then a great result would have been achieved. If at the same time a certain amount of gas was produced, a certain amount of oil, a certain amount of sulphate of ammonia and other things for sale in the market then it would have been a very great achievement. He hoped that the research departments of the Gas Industry would continue to investigate along these lines, because in that way a very great reform would be achieved.

The Society and the B.G.F.

Mr. F. J. West, responding, first expressed the appreciation of the members of the presence of Sir Robert Horne. After expressing regret at the absence of Colonel Carr, Mr. West said that the progress and development of the Society during the year under the able Chairmanship of Mr. Henshaw was well shown in the Annual Report, which showed also very clearly that the Society was eager and ready to take its share in the conduct of the Industry by co-operation with the other Associations under the auspices of the British Gas Federation. He knew everybody would wish him to say to Sir David Milne-Watson, the Chairman, that as far as the Society was concerned they would endeavour to continue to pull their weight. Lord Dudley, a Past-President of the Society, indicated very clearly, in an Address he gave at the British Industries Fair, the part which the various organizations could play by co-operative effort. Lord Dudley had said: "The British Gas Federation was formed to make even more effective that co-operation which over a period of years has been achieved between the different Associations representing various activities of the Gas Federation, which acts to-day as the mouthpiece of the Industry on questions of common policy, and it is an Industry which must have a national outlook."

Continuing, Mr. West said that, apart from their own domestic affairs and the happy relationship with the other organizations, it was necessary to consider what this national policy was to be. They wanted, for one thing, more consideration for the Gas Industry in Government circles. [Hear, hear.] They wanted an outlook from the politicians which would create an atmosphere abolishing the thought and general expression suggesting that the Gas Industry, to some extent, was a back number. It was very encouraging to hear Sir Robert Horne speak in the way he had done, and he hoped that that subtle psychology—to use Sir Robert's own words—of which politicians were capable would result in a more tolerant outlook with regard to what the Industry was doing—the millions of money that were employed in it and the large number of men which it employed—and correct that trend of public opinion which was so damaging to them in pursuing their activities. It was an impression which was strengthened by the way most politicians and many Government Departments regarded electricity, and the way that industry was subsidized. If the Gas Industry could only have fair play and a more tolerant outlook, he believed public opinion would be steadily changed.

A more tolerant outlook was also required on the part of some municipalities and public bodies with regard to the housing question, and the right of the Gas Industry to participate in the supply of domestic appliances. Further, a more tolerant outlook was necessary with regard to the proper share of the Industry in public lighting, and, finally, they wanted the removal of the restrictions which trammelled them in fixing rates and tariffs and general charges which at the present time hampered development.

These, concluded Mr. West, were a few of the points on which they, as members of the Society of British Gas Industries, could focus their attention and in which they could play a useful part in furthering their ends.

The Efficiency of the Industry.

Mr. E. J. Fox (Past-Chairman of the Society) proposing the toast of "Our Guests" said he was a Director of what he was going to claim to be the most prosperous manufacturing concern in the electrical industry, and Mr. Cyril Lloyd, who was also present, happened to be a Director of Associated Electrical Industries, Ltd. [Laughter.] He could not help feeling that one of the important reasons why the Gas Industry to-day was so eminently effective and efficient was the close co-operation which existed between the manufacturers of machinery and the users of it. Furthermore—and he said it in all sincerity—if he were asked as an ordinary outside industrialist to express an opinion as to which was the most effective and efficient industry in this country, he would name the Gas Industry. He could not help feeling that to no small extent those who were largely interested in the Industry—and he himself was only partially interested—owed a very great debt of gratitude to the leader with whom they were blessed—Sir David Milne-Watson. [Loud applause.] There was an old Italian proverb, "The world will always stand aside and let him pass who knows where he is going"—[loud laughter and applause]—and he could not help feeling that had a very good application to Sir David.

Speaking more directly to the toast, Mr. Fox said it would have been his privilege to couple with it the name of Colonel Carr, the President of The Institution of Gas Engineers, but in his absence he welcomed Mr. Valon Bennett, a Past-President, and in doing this he extended the thanks of the Society to all the guests for their presence and for the support which the Society had received during the year.

Mr. C. Valon Bennett, responding, said he knew nobody more regretted being unable to be present than Colonel Carr himself. This dinner, continued Mr. Bennett, was one of the functions which those who were fortunate enough to be invited attended knowing full well that they were going to have a happy evening, and this year had proved no exception.

This time last year, continued Mr. Bennett, he had mentioned the formation of the British Gas Federation, but optimist as he himself was, he was quite sure that in May, 1935, he did not think such progress could be made as had actually been the case during the past twelve months. When he had mentioned the formation of the Federation last year he appealed for wholehearted support for it and that most certainly had been given. He now asked himself "Why have things gone so well," and he was confident he was right when he came to the conclusion that it was due to hard work combined with the enthusiasm of Sir David Milne-Watson, who was the originator of the idea.

Passing to another matter, Mr. Bennett said he was very conscious of the compliment paid him by some members of the Society having taken notice of a suggestion he made that they should make it known in their advertisements in the technical Press that they *were* members of the Society. He hoped that other members would also adopt the suggestion with the same kind of success as he understood those who had already done so had met with in the way of added business.

Continuing, Mr. Bennett said that everyone present was interested in the Gas Industry in one way or another. As a gas engineer, he himself was interested in everything connected with gas, and although everyone who held office such as he did recognized the whims and fancies of the public, which were often based on misleading advertisements, it was not so easy to obtain new and retain old business as it was, say, 20 years ago. Yet it was significant that there was no falling off in the Industry. Indeed, the reverse was the case. He feared he had digressed considerably from the duty which he had to perform in replying to this toast, but he wished still to make a reference to the young men for the reason that the Society of British Gas Industries had that day formed a Gas Development Section. He wanted the young men of this country to realize that the Gas Industry was a live one, full of interest and more progressive than ever. There was no room in it for the incompetent person, but there was unbounded scope for the efficient person who was determined to give real service. When, however, he considered the necessity of employing the right type and right class of man, and when he recognized that these men must not only fit themselves by examination, but must also be fit men to carry out the duties required of them, he wished to emphasize that they must be encouraged by being able to obtain posts which were well paid. [Hear, hear.]

Finally, Mr. Bennett referred to Mr. Henshaw, Chairman of the Society, and said the guests admired his good qualities just as much as did the members of the Society. If he said all he could about Mr. Henshaw it would probably upset his natural modesty, but he would say that to know Mr. Henshaw was to love him, and that was saying a great deal. [Applause.]

"The Chairman."

Mr. D. M. Henshaw proposed the final toast of the evening—viz., "The Chairman," and remarked upon the affectionate and appreciative terms in which previous speakers had referred to Sir David, who had consented at very short notice to preside at this dinner owing to the regretted absence of Sir John Cadman. That was characteristic of the ready help which Sir David was always willing to give the Industry. The manner in which Sir David guided the Industry suggested that, had he been on the other side of the Industry rather than on the supply side, he would have been an outstanding contracting engineer or appliance manufacturer, and, instead of concerning himself as he had done in consolidating the Industry and bringing it to a position of great importance and solidarity, he would have been forming groups of manufacturers and plant makers which would even have vied with such concerns as the I.C.I. or Associated Electrical Industries, Ltd. Everybody appreciated Sir David's work in connection with the British Gas Federation and his remarkable faculty and intuition in carrying out such large amalgamations as that which had brought the Federation into existence. It was in this way that Sir David showed himself to be a real leader. Commenting on Sir Robert Horne's reference to coal supplies, Mr. Henshaw suggested that the Gas Industry was well able to take care of coal conservation in this country, and plant and apparatus makers could supply all that was necessary to meet the needs of the population not only in the matter of gaseous fuel but also as regards a smokeless residue and the by-products.

Sir David Milne-Watson, responding to the toast, very much appreciated what had been said of the part he had played in the development of the Industry. Emphasizing what Sir Robert Horne had said as to the national importance of the Industry, Sir David remarked that Sir Robert's remarks applied to the carbonizing industries as a whole, and for that reason he was very glad indeed to see members of the coke oven industry present, The two industries were becoming more and more linked together.

Continuing, Sir David said that the British Gas Federation,

founded 18 months ago, had bound together the various elements in the Gas Industry, and he believed it was already proving itself a great power for good and for happiness in the Industry and, through it, in the affairs of the country. Sir Robert Horne was not wrong in saying that it lay in the hands of the Industry to make this country a smokeless country and to put it into the position of utilizing its fuel resources to the amplest possible degree. The electricity industry was increasing year by year and continually boasted of its progress, but it did not use coal nearly so economically or so well as did the Gas Industry, and that was a fact which, sooner or later, would impress the country.

The Coal Industry.

Sir David then dealt once again with the Government's proposals with regard to the coal industry, and said he did not believe the country realized—in fact he knew it did not—the seriousness of these proposals. The proposals were of such a character that he believed they would do enormous injury not only to the Gas Industry but also to the coal industry itself. [Hear, hear.] Personally he did not believe that any industry should be trusted with a complete monopoly, yet that was what the Government's proposals meant. To allow the coal industry to be able to say what prices should be charged, without any regulation, and also what quality of coal it would supply, whether it was the quality desired by the Gas Industry or not, was absolutely unconstitutional and intolerable. Moreover, speaking not merely as Chairman of a gas company, but as one of the vast multitude of citizens who were consuming coal in some form or other, he maintained that to give a basic industry an absolutely uncontrolled monopoly of this kind, which was rightly denied to gas, water, or electricity, or to the railways, was an outrage on the constitutional history of this country. Therefore he hoped that everybody in the Gas Industry, whether they be directors, managers, or consumers, or industrialists using coal, would take every possible step to see that the public was thoroughly roused in this matter. After all, it did not end with gas or electricity, because, if the price of coal was increased, it would mean an advance in the price of electricity and gas, and then it became a matter of concern for every home in the country, and in many other directions of an industrial nature. Nobody grudged the miners a decent wage. The Gas Industry paid the 1s. extra per ton which was asked of them in respect of existing contracts, a most unheard-of thing. That increase, however, was paid to give the miners better wages, but the Industry was not prepared to pay any price for coal and use any coal put before it simply in order that the coal industry might exploit the public. The point was that time was slipping by in connection with the Bill. They were now in the middle of May, and the scheme had to be in operation by August, and unless they made themselves heard all over the country it would be too late. If the measure went through in its present form it would certainly make gas and electricity and coal more expensive to the citizens of this country.

In thanking Mr. Henshaw for his kind words, Sir David said it had been a great pleasure to him to be in the Chair on this occasion. He had very pleasant recollections of his own year of office as President of the Society and of the very cordial welcome which had been given him at that time. Now he felt all sections of the Industry were linked together by a more permanent and stronger bond because they were all members of the British Gas Federation which was now doing excellent work. It was the regret of everyone that Sir John Cadman had been unable to be present, for he was one of the leading industrialists of this country, a man who had done an enormous amount of work for the nation in the development of the oilfields of Persia and in many other directions, and everybody sincerely hoped Sir John would make a speedy recovery.

THE RE-ORIENTATION OF Gas Research

by H. HOLLINGS

On Thursday, May 7, Members of the Midland Junior Gas Association were addressed by Mr. H. Hollings, Chief Chemist of the Gas Light and Coke Company.

During the last quarter of a century a great deal of research work of all kinds in the Gas Industry has been directed towards higher standards of efficiency. As a result we have seen striking reductions in the cost of gas manufacture due to the adoption of more efficient methods coupled with scientific control on the works. The thermal efficiency of gas utilization has also improved. The result has been a marked increase in the value given to the gas consumer. This is so marked that in certain districts the quantity of gas being sold to-day is appreciably less than it would have been if the older and less efficient apparatus had not been replaced. However, we should not regret any temporary decrease in business due to this cause as it indicates a much more secure foundation upon which an increased business can be built in the future.

The security of this foundation also depends upon the quality of the products we have to sell and upon the general attractiveness of the apparatus which is available to the public for the consumption of those products. Thus at the present time there is a shift of the centre of gravity of our programmes of research and technical investigation. In connection with gas manufacture more attention is being paid to gas quality and coke quality, too, than has always been paid hitherto, and similarly still more consideration is being given to the external appearance of appliances and the convenience with which they may be used by the public. It is my present purpose to indicate very briefly one or two lines of investigation which are of particular interest in view of present circumstances.

So much has been achieved in connection with the removal of naphthalene and water vapour from gas that there does not appear to be much scope at the present time for further research directly in connection with their removal. The more obvious field for further research work directed towards a higher standard of purity is in connection with the removal of sulphur from gas.

It is generally agreed, at the present time, that the use of gas for purposes which involve the discharge of products of combustion into a closed room is restricted very largely because of the small quantity of sulphur dioxide in the products of combustion. The sulphur which is responsible for this exists to the extent of about 80% in the form of carbon disulphide and to the extent of about 20% as thiophene. There are relatively low concentrations of other sulphur compounds concerning which little is known.

Prior to 1914, the South Metropolitan Gas Company introduced a process for the removal of carbon disulphide by catalytic treatment of the gas. In respect of carbon disulphide, this is a highly efficient process, but it would appear to be rather expensive and it may be questioned whether, with the rapid advances which have taken place during quite recent years concerning the properties of catalysts, it would not be worth while to commence *de novo* a search for a new catalytic process for the removal of carbon disulphide and perhaps of thiophene too. One of the essentials of any such new process would be that it should operate at a lower temperature than the existing nickel catalytic process, as it is upon this working temperature that the costs of the process appear to depend very largely.

It is well known that most of the thiophene, and about one-quarter of the carbon disulphide, are removed from gas during the removal of benzole by the oil recovery process. This means that when benzole is removed from coal gas the sulphur concentration of the gas is reduced to just over 60% of the original concentration.

The Active Carbon Process.

In the active carbon process of benzole recovery, which has been adopted at three London works, the proportion of sulphur removed is 80%. The 20% of sulphur which passes forward with the treated gas is in the form of carbon disulphide and other more volatile constituents displaced from the carbon by the benzole.

It will be realized, therefore, that the sulphur content of gas treated by the active carbon process is as low as that of gas treated by the older nickel catalytic process.

The adoption of the carbon process involves the removal of benzole from gas, but under present conditions the profit on the sale of the benzole is in many cases more than sufficient to pay for the cost of the removal of the sulphur.

Many works are already equipped with plant for the removal of benzole by the oil washing process, and it would be very expensive in many cases to substitute the carbon process, even though the efficiency of sulphur removal may be doubled. It is, therefore, a matter for investigation to consider how the efficiency of sulphur removal in the oil washing process can be increased.

One way in which it can be increased very substantially involves the circulation of a larger quantity of wash-oil through the washer. If four times the normal quantity of oil is circulated the efficiency of sulphur removal can be doubled. Normally, this step is prohibitive because of the extra steam consumption which it entails in the distillation of the oil. In one experimental plant erected by the Gas Light and Coke Company it is being sought to avoid the excessive steam consumption by operating the still under a carefully chosen reduced pressure, the exhaust steam from the vacuum pump being used as process steam.

Another matter which calls for investigation is the circumstance that in certain areas gas is found to contain minute quantities of gummy material which cause trouble in some of the more sensitive types of appliance. Apparently this is a difficulty which is being encountered in certain areas only. At this stage it is not possible to give any very comprehensive account of investigations which are in hand to elucidate the cause of formation of gum and to design appliances less sensitive to the presence of minute particles suspended in the gas, but it may be appropriate to indicate one or two observations of practical significance which have emerged.

It is generally agreed that nitric oxide is necessary for the formation of the particular kind of gum with which we are concerned. Where there is no nitric oxide there is no formation of what has been called vapour phase gum. Hitherto, it has been very generally supposed that the source of nitric oxide in coal gas was the waste gas drawn into the retort from the combustion chamber. Recent experiments indicate, however, that when the nitric oxide in crude gas exceeds about 3 parts per million it is far more likely that the nitric oxide is being formed by the combustion of 1 or 2% of air just inside the lid of the retort.

When a small flame of air burns in an atmosphere of crude gas under such conditions that the products of combustion are rapidly chilled, owing to the radiation of heat to surrounding ironwork, concentrations of nitric oxide up to 10 or even 20 parts per million may be produced.

It is suggested that this observation is of interest not only in connection with investigations of gum formation, but also in connection with attempts to increase still further the efficiency of gas manufacture. When the inert constituents of coal gas are reasonably low, it is impossible to tell by a mere inspection of the conventional gas analysis whether the nitrogen present is derived from air which has burnt with producer gas in the combustion chamber, or air which has burnt with coal gas in the retort. A determination of nitric oxide in the crude gas now provides a means of settling this question and should facilitate the prevention of loss of gas by burning.

Settlement of Gum Particles.

Another observation is that the presence of water vapour has an important effect upon the rate of settlement of any gum particles which may have formed in the gas. At one works where the gas drying plant was moved from the inlet to the outlet of the holder, so that the gas was stored wet instead of dry, the amount of gum in the gas leaving the works during the three months after the change was less than 6% of what it was during the three months before the change.

With the more exacting demands of consumers more attention is being paid to the flame characteristics of different gases. Perhaps the most important quality of gas affecting the flame characteristic is the specific gravity, but it must be determined to what extent the behaviour of gas in typical appliances is influenced by other qualities. This matter is being investigated, and the results of this enquiry, in so far as they may affect design of appliances or in so far as they may impose a limitation upon the flexibility of gas production will be watched with the closest interest.

If we turn from gas manufacture to gas utilization we see a similar broadening of the basis of research work. There has been within recent years a marked improvement in the thermal efficiency of gas appliances. To-day, however, the consumer demands not only an efficient apparatus but one which is designed to harmonize with modern surroundings and one which can be kept clean without the expenditure of much labour. Rapid progress is being made in the replacement of black ironwork by coloured enamels.

Again, the public demand is growing for appliances which can be used at least as conveniently as similar appliances using competitive forms of energy. Thus there is need for widespread investigation concerning a variety of details such as taps, connectors, methods of gas ignition, and thermostatic control.

If what has been said concerning the direction of effort towards the improvement of gas appliances is true, it is surely still more true if said of coke appliances. Coke is one of the cheapest fuels, and there are on the market many appliances in which it can be burnt with a reasonably high degree of thermal efficiency. Some of those appliances are of good appearance and they can be used by the consumer with a minimum of labour for refuelling and de-ashing. Also some furnaces and stoves are equipped with excellent temperature control devices. In many directions progress has been made in improvements of other apparatus, but much remains to be done. The general standard of coke appliances is one with which the Industry should not remain satisfied.

In the foregoing I hope I have said nothing which may be regarded as detracting from the value of the work which any individual may be engaged upon at the present time. It is obvious that at all times a certain proportion of the technical effort of the Industry must be directed towards a maintenance and improvement of thermal efficiencies of gas manufacture and utilization. My suggestion is that whereas in the past a research organization as a whole may have been justified if it resulted in increased efficiencies, the position of the Industry to-day is such that in the immediate future all our larger research organizations must be directed towards still further improvements in the quality of our products and in the general utility of the apparatus in which they are used. This can be done without diverting the whole of the available man-power away from considerations of efficiency.

It will be a great mistake if any falling away from the present high standards of manufacturing efficiency is permitted, as it is upon these that the commercial structure is dependent. In the discussions of various methods of charging for gas which are of such vital interest at the present time in our effort to promote increased sales of gas in the face of competition, it should not be overlooked that the more promotional the tariff of gas charges the more sensitive does it become to any increase in the cost of making gas. At a time when the cost of coal and most of the materials used on the works is tending to increase, low costs of manufacture can only be maintained by continual attention to efficiency.

In this brief review of the trend of research I have omitted any reference to the possibility of making synthetic motor spirit or oils from gas-works products, as my object was to direct attention to those research questions which appear to me to be of the most general and immediate interest. The adoption of any such synthetic process in competition with natural materials must be dependent upon a definition of national policy upon matters outside the scope of this Address.

Vote of Thanks.

At the conclusion of the Paper the President, Mr. F. L. Atkin, said it had certainly been an original Address, which provided much food for thought. The old problem of sulphur removal kept cropping up and that part had been very interesting. It appeared that it was only with certain types of appliances that sulphur caused trouble; there were many uses to which gas could be put where the presence of sulphur was not a disadvantage, and, therefore, the cost of its removal would be charged against appliances where the sulphur did not matter. He wondered if it would be possible to get something which could be fixed to appliances so that the burden of cost would not be spread over all equipment.

Mr. T. F. E. Rhead (Birmingham), in proposing a vote of thanks to the lecturer, said how much they appreciated Mr. Hollings' visit. In his address he had touched on the question of removing research from the retort house to the district. While he agreed as to the need for research on the district, he felt that such work in the retort house ought not to be relaxed. In his opinion it was a tragedy that an Industry with so large an income as the Gas Industry should spend such a comparatively small amount (less than £10,000 per annum) on research work.

The question of sulphur removal was one that until it was solved constituted a reflection on the chemists in the Industry; being a chemist, he could say that with safety. Mr. Hollings had given also some valuable particulars of work done in London in regard to gumming. It was certainly an important discovery that 2% of air leaking into the retorts might make all the difference between having gum trouble and not having it. He thought work in connection with the improving of gas ap-

pliances needed to be intensified. People were greatly impressed for instance with self-lighting gas fires.

Mr. F. A. JENKINS (Leamington), in seconding the vote of thanks, said the reference to gum formation was particularly interesting because it was a subject that had forced itself on their notice very much in the last few years, and most of them did not know much about it. They awaited further investigation with great interest, in that direction as well as in regard to specific gravity and the effect of other considerations on flame formation. He would be very interested in the result of such investigations when they were published. He thought there was a great advantage in encouraging research even in the smaller undertakings; they might not be able to make any great contribution to the general knowledge of the Industry, but he believed such work was very valuable and useful.

The vote of thanks was carried with acclamation.

LONG SERVICE TO THE GAS INDUSTRY

A number of firms of long standing on the contracting and manufacturing side of the Industry have collaborated with the "JOURNAL" in the production of a series of articles, under the above title.

Whessoe Foundry and Engineering Co., Ltd.

If we begin this retrospect by a glance at the last quarter century to see what was being done by contractors to the Gas Industry at that time, we find that the Whessoe Company in 1911 was even then a century old firm. It was, however, graduating from "general engineering" and concentrating on defined lines of work such as gas plant manufacture, on which the Company had already been engaged for a considerable number of years.

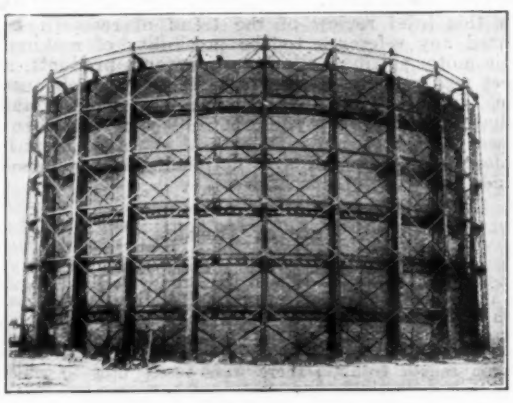


Fig. 1.—An Early Gasholder.

In many works there are gasholders still in active service which bear the name Whessoe and date back well beyond the period under review. These holders—possibly to-day a little antiquated in appearance—represented strenuous labour at Darlington, as the Whessoe Company's Works were by no means so well equipped for this type of construction as they are to-day. A six million holder such as that illustrated in fig. 1 in those days meant considerable activity for all concerned.

To chronicle the history of the Whessoe Company for the years 1911-1936 would be to trace the logical development of an engineering company (interspersed with wartime activities), and it may be said that this development followed closely the trend of those industries on supplying which the Whessoe Company concentrated, namely, the gas and by-product undertakings and the petroleum industry. Suffice it to say, then, that the Whessoe Foundry Company, as it was called at that time, was even then making, besides gasholders, the Whessoe Rotary scrubber—a washer for ammonia and naphthalene extraction—purifiers, condensers, tower scrubbers, retort bench castings, weigh bridges, cast-iron and steel tanks. The manufacturing of these and many other items was continued through the war years, and in modified forms right up to the present time. The Whessoe washer scrubber, for example, was largely used for cyanogen extraction during the war, but now its most common application is either ammonia or benzole extraction (fig. 2). Purifiers form another example, and although the principles of their construction remain the same, the purification plant now built by the Whessoe Company is, of course, well in advance of the equipment made 25 years ago, both as regards operation and maintenance.

Recent Developments.

Turning to recent activities, a development of note is the availability to-day for gas condensing of scientifically designed horizontal water tube type (fig. 3) condensers, in

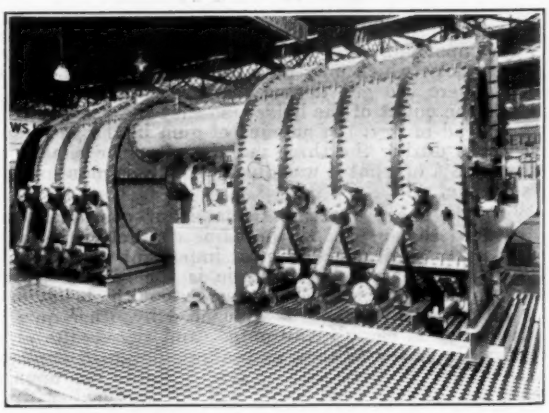


Fig. 2.—A Rotary Washer Scrubber on Exhibition at the B.I.F.

which gas and water flows are controlled to give maximum heat transfer and minimum water consumption. Another process which twenty-five years ago was probably among

the least efficient of any on a gas-works was tar extraction. Now it is undoubtedly the most efficient and complete. The introduction of electrical precipitation, and the W.W-D Electro Detarrer in particular (fig. 4), with its guaranteed 99·5% removal of tar fog from gas, strikingly exemplifies what the Whessoe Company is doing in this direction for the Gas Industry. The savings of back pressure and the increased scrubbing and purifying efficiency consequent upon the installation of a W.W-D Electro De-

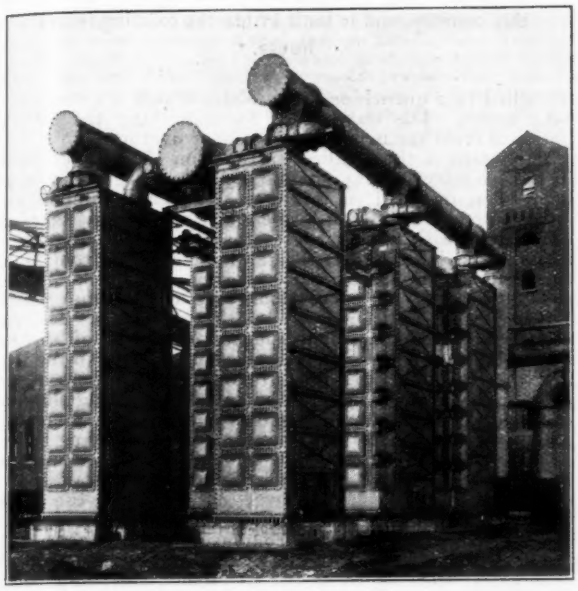


Fig. 3.—Cooling 18 million cu.ft. per day—water gas condensers.

tarrer contribute to works efficiency more than any item of gas treatment plant has done in the past. Details of two plants working on the system were given in full in the "JOURNAL" as recently as Jan. 22.

In Kindred Industries.

The development of their gas treating processes has made for a close relationship of the Whessoe Company with all those industries where fuel gases are produced. With the Gas Industry is linked the coke oven industry. The blast furnace industry and users of producer gas are also concentrating on effective methods of gas treatment, and com-

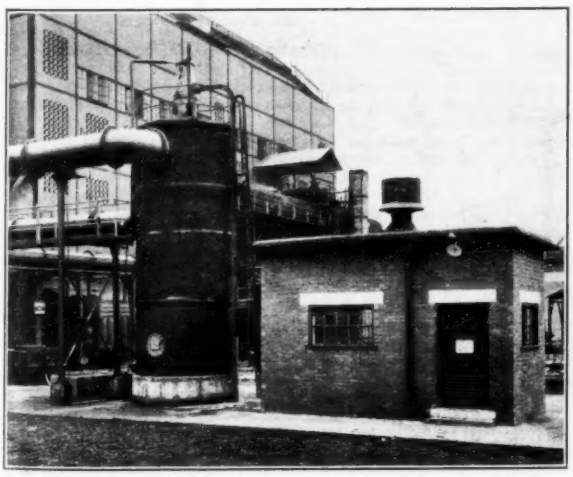


Fig. 4.—Modern Tar Fog extraction by the W.W-D Electro-Detarrer.

mon to these four industries are such processes as temperature reduction and gas cleaning, &c. Condensers, as they are called on gas-works, are analogous to primary and secondary coolers on coke oven plants, and pre-coolers for blast furnace gas and producer gas treatment.

The Whessoe Company provides a complete service of present-day designs and plants for this phase of fuel gas treatment, and likewise offers electrical precipitation plant for dust as well as tar fog removal. For example, a 2½ million a day W.W-D Electro Detarrer may be contrasted with a Whessoe blast furnace gas precipitation plant removing dust from 96 million cu.ft. per day. Another plant, the W-Z Disintegrator (a mechanical fan type cleaner, illustrated in fig. 5) finds many applications in the removal of dust and tar fog from the gas from coal-fired producers, though it is not often employed on gas-works. This is quoted as an example of the fact that, although the processes of gas treatment in differing carbonizing industries may involve similar principles, the design of plants most suited for a particular application may differ considerably.

The Whessoe Company's steel plate department (where tanks and chemical process and pressure plant are made) produce spherical and cylindrical pressure gasholders, forming yet another type of equipment which Whessoe has contributed in recent years. This department was responsible in 1935 for over 300 tanks for all types of liquid storage, the total capacity of which exceeded 100 million gallons—tank sizes ranging from 50 gallons to 3·3 million gallons each.

Welding.

Another branch of engineering which has been the subject of outstanding development in the last quarter of a century is welding. Twenty-five years ago such things as operators' qualification tests, classification of electrodes, and adopted amperages for the various types of welds were not thought of. To-day, when Whessoe products are to be welded, they are designed on correct welding practice, as opposed to just welding a structure previously designed for riveting. Shop equipment and field welding plant have been selected to produce the results which the Whessoe Company has aimed at in order to be at the forefront of this type of construction.

Steel work corrosion is yet another subject to which the Whessoe Company has devoted special attention, and investigations prove that the enormous wastage caused by

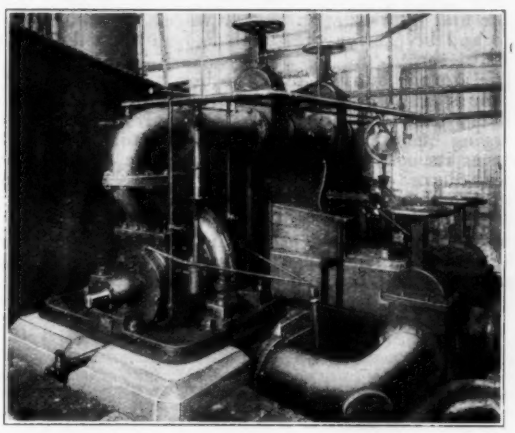


Fig. 5.—A Mechanical Cleaner for Producer Gas—the W-Z Disintegrator.

corrosion can largely be prevented by initial protection. This necessitates the removal of mill scale from the steel by acid pickling, immediately followed by the deposition of a protective film. By immersing the steel material in a phosphoric acid bath of the correct strength, a film of iron phosphate coats the surface of the steel section or plate, preventing initial corrosion and subsequent rusting. The iron phosphate film is covered by a shop coat of paint, which, owing to the steel being treated as previously described, forms a very close bond. The cost of the process is recovered in a few years in that scraping and repainting operations are needed less often. By avoiding corrosion, the life of the steel structure is prolonged—the ultimate savings, therefore, of this process may be enormous.

The Whessoe Company expects to celebrate its 150th anniversary in a few years time, when further opportunity will occur of glancing back over the historical side of its development and management. Meanwhile the Company's constant policy is to provide well designed equipment to industries which deal with fuel gases, and to offer new processes only when they have been proved and tested by the Whessoe Company in actual practice. There is a feeling abroad to-day that it is in their mutual interest that the gas undertakings and their contractors should work together for mutual future prosperity. With this sentiment the Whessoe Company is in full agreement, and it will continue, as it always has done, to co-operate in this sense to the fullest extent of its capacity.

THE INAUGURATION OF
Vertical Chambers at Milford Haven

On Friday, May 15, the Vertical Chambers erected for the Milford Haven Gas Department by W. J. Jenkins & Co., Ltd., were officially inaugurated.

Particular interest attaches to this installation, since it is the smallest Chamber Oven Plant in this country, and is built inside the existing retort house.

The new installation of intermittent vertical chamber ovens at Milford Haven occupies the site originally taken up by two settings of six stop-end horizontal retorts, and is built inside the existing retort house, which has a span of about 26 ft. It consists of one bench of four entirely independent chambers, each being a completely separate heating unit. Each chamber has a nominal capacity of 1·4 tons of coal, and the four are capable of carbonizing about 10 tons of coal per 24 hours. Each chamber is heated by producer gas obtained from a common CO flue, which in turn is supplied from two step-grate producers, either of which can be worked as required to serve three chambers when on a low output. The bench is equipped with coal and coke handling and storage plant.

Coal is received by rail wagons on the Council's sidings, is hand discharged direct into the hoist skip, and is then elevated to the overhead storage bunkers above the bench. The skip hoist has interesting features. The power required is obtained by means of a winch driven by a Sisson's totally enclosed high speed steam engine, situated inside the retort house. The hoist is automatic in that at each terminal point the skip stops without attention. A further feature is the skip, which is detachable from its frame and is fitted with runner wheels to enable producer coke and breeze for the plant to be obtained from other parts of the yard.

The storage bunkers over the bench have a capacity for 48 hours' supply of coal, coke, and breeze. From the bunkers coal and breeze are received into the chamber charging bus which runs on the bench top and which discharges its contents by gravity into the oven below, the breeze charge being used to form a protective pad for the discharge doors of the oven. After carbonization of the coal has taken place the resultant coke is steamed for the production of water gas. After the period of steaming, the coke is discharged into a bucket type side tipping wagon running on rail track below the ovens and is then hand propelled to a quenching table, above which is a steam offtake tower. The water used for quenching the coke is obtained from the oven discharge door overflows.

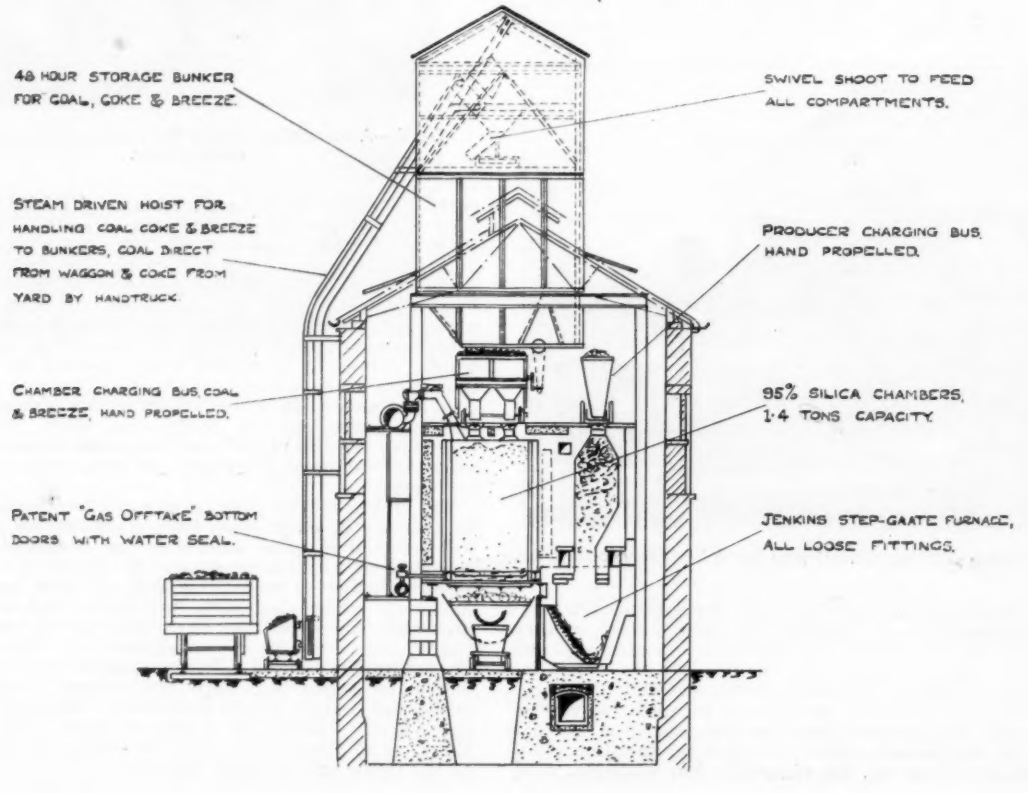
This plant is the smallest installation of chamber ovens in this country. Many similar types for larger gas-works have been installed in recent years. The chambers are constructed of 95% high grade silica material designed in accordance with Jenkins' latest practice; each chamber is about 13 ft. high by 6 ft. 9 in. wide, tapering from 10 in. to 12½ in. on the minor axis.

The chamber discharge doors are of Jenkins' patent "Gas Offtake" type arranged with water seals. This gas offtake arrangement provides means for taking off the gas at the bottom of the chamber oven in addition to the top, and thereby eliminates pressure in the lower part of the oven. The producer gas is fed into the heating flues on each side of each chamber and is consumed in successive stages throughout the height of the oven, this being known as the "delayed combustion" principle, and gives uniform heating of the oven throughout length and breadth, and ensures a uniform coke product. After heating the chamber the waste gases pass through recuperators where the air required for heating gas combustion is preheated.

The plant has been designed and arranged to ensure economical working in so far as labour, fuel, and power requirements are concerned, and control instruments of the latest type have been provided. The regulation of vacuum on the chambers is by means of an "Arca" regulator, which gives extremely sensitive and positive control.

This plant not only ensures economical labour requirements, but greatly reduces the arduous duties associated with hand charged horizontal retorts.

Although of small dimensions the existing retort house was sufficient to accommodate the new plant without structural alterations and at the same time without restricting the working space necessary for easy and efficient operation; further, there remains ample space for the addition of 75% increase in the output of the plant.


48 HOUR STORAGE BUNKER FOR COAL, COKE & BREEZE.
SWIVEL SHOOT TO FEED ALL COMPARTMENTS.
STEAM DRIVEN HOIST FOR HANDLING COAL COKE & BREEZE TO BUNKERS, COAL DIRECT FROM WAGGON & COKE FROM YARD BY HANDTRUCK.
PRODUCER CHARGING BUS. HAND PROPELLED.
CHAMBER CHARGING BUS. COAL & BREEZE. HAND PROPELLED.
95% SILICA CHAMBERS. 1·4 TONS CAPACITY.
PATENT "GAS OFFTAKE" BOTTOM DOORS WITH WATER SEAL.
JENKINS STEP-GRATE FURNACE, ALL LOOSE FITTINGS.

The York Gas Bill

House of Commons Committee

(*Before Sir* RICHARD MELLER (*Chairman*), *Captain* O. PEAKE, *Mr.* F. B. SIMPSON, *and Mr.* LOVAT FRASER.)

The Bill promoted by the York Gas Company was considered by a House of Commons Committee on Monday and Tuesday, May 11 and 12. Its object is the same as that promoted by the Gas Light and Coke Company—*i.e.*, to provide that housing authorities within the York Company's area of supply should afford the Company facilities to provide gas pipes in houses and other buildings during course of erection, or during alteration or conversion.

The Company was represented by Mr. W. E. Tyldesley Jones, K.C., Mr. F. J. Wrottesley, K.C., and Mr. H. Royston Askew.

The only opposition was that of the York Corporation, represented by Mr. E. J. C. Neep.

Mr. F. J. WROTTESLEY, K.C. (opening the case for the Company), said that the Company's area of supply comprised the City of York and an area within a distance of 7 miles around the Ouse Bridge in the City. It includes three townships and parts of other townships and rural districts within the three Ridings of Yorkshire. The issued share capital is £420,374 10s. and the loan capital £125,000. so that the total issued share and loan capital is more than half a million pounds.

The Bill, said Counsel, was not confined to local authorities which were electrical undertakers, but would apply to County Councils and other authorities. The North Riding County Council had submitted a clause similar to one already applying to the West Riding, giving protection in respect of works in roads, bridges, &c., but it had nothing to do with the principle with which the Bill was concerned. The West Riding County Council had postponed any objections it might have to the Bill until the second House. So that no County Council and no Rural Council (and there were eight of the latter in the Company's area) opposed the Bill. Indeed, the Bishopsthorpe Rural District Council had decided unanimously not to oppose it, so that it might be regarded as being in support of the principle of the Bill.

The policy of the Corporation of York, who were electricity undertakers, had been for some time to provide for the use of electricity only on the housing estates they erected. The corollary had been in fact and in effect to compel their tenants to support the Electricity Department, whether they wanted to or not. Since 1919 the Gas Company had pointed out from time to time to the Corporation the advantages of a gas supply, and from time to time they had been permitted to provide certain types of plant. But the Corporation's policy had been increasingly to go in for all-electric houses. As far back as February, 1922, the Company had received a petition from 111 residents on a Corporation housing estate asking for gas.

In the early days of the provision of housing estates it had been customary for housing authorities throughout the country to pay for or to contribute towards the cost of running mains into new housing estates; and it had been most certainly the practice for them to equip their houses, at their own expense, with gas pipes or electrical wiring, or both. But subsequently, in some places, including York, the Corporations provided only the wires free of charge. Sometimes, perhaps, the cost was charged to the Housing Department and sometimes to the Electricity Department; the usual course was to charge the Housing Department, which meant, of course, that the wires were paid for out of rates or out of taxes. Without doubt, the wiring in the Corporation houses at York had been provided at the expense of the ratepayers or taxpayers. The result of such activities was that gas companies had been driven to offer to provide mains and also to carcass houses free of charge.

Naturally, there had been protests from time to time by the York Gas Company. In reply to such a protest, in July, 1929, the Chairman of the Housing Committee had written a letter in which he had stated that the position, so far as he understood it, was that enquiries were being made as to the success or otherwise of the electric houses and future policy would depend on the result of the report. In any event, he had added, the Directors and local shareholders of the Gas Company had no cause to worry, because as ratepayers they were concerned in the success of the Corporation's electricity scheme. He felt, therefore, that they must look at it, whatever the decision of the Corporation might be, as a case of losing on the swings and winning on the roundabouts. Counsel commented that in connection with another Bill the Committee had heard of a so-called 50/50 arrangement, whereby a housing authority owning an electricity undertaking proposed to carry out all the lighting on housing estates by electricity, and half the cooking; it seemed that the Chairman of the Housing Committee at York was expressing a similar sort of mathematics.

Counsel quoted extracts from correspondence between the Gas Company and the Corporation with regard to housing estates, to indicate the Corporation's decision not to depart from their all-electric policy, and he also quoted from some of the Housing Committee's minutes.

Mr. NEEP pointed out that on the Tang Hall estate (commenced in 1920) the Corporation had paid for gas piping.

Mr. WROTTESLEY agreed, and said it confirmed his statement that previously it was the practice of the Corporation to pay for the piping. But the Gas Company had gradually been brought to a position in which they had to provide the piping, whereas wiring was paid for out of the pockets of the ratepayers—and the Gas Company were ratepayers. It had been stated that tenants were not refused permission to have a service of gas if they desired. The cost of carcassing after the houses were constructed, however, was prohibitive, and refusing permission to carcass the houses at the time of construction meant refusing the tenants the use of gas, which was against their wishes.

Overwhelming Demand for Gas.

Following a petition to the Gas Company for a supply of gas, a canvass had been made of householders, and letters had been received from certain members of the Corporation regretting the Corporation's action; they were in the minority, however. The people who were moving into the all-electric houses were previously the Company's customers. In 1935 a canvass was made of people who were living in houses that were to be demolished and who were to be provided with houses by the Corporation. Definite orders had been received from 138 tenants out of the 142 before they had moved; the 138 represented more than 97%. At Huntingdon Road Estate, 88 out of 104 householders had signed a petition. Following that, the Company had canvassed, and the demand was so overwhelming that they had decided to lay mains. The Company had been driven to lay the mains behind the houses.

Mr. NEEP replied that that was the result of an amicable arrangement between the Corporation and the Company.

Mr. WROTTESLEY agreed, but pointed out that they would not have been laid in that position if they had been laid at the proper time. The mains should have been laid and the carcassing should have been done when the houses were being erected. The tenants, having had experience of electricity, wanted gas, and they had to be subjected to all the inconvenience and discomfort arising from carcassing their houses during occupation.

In one letter it had been stated that if permission were granted to lay the mains behind the houses it would not be a consent to take services into the houses or to pipe them. Counsel asked the Committee to consider how such an attitude could be maintained in view of the policy of Parliament, as expressed in the Gas Undertakings Act of 1934, whereby consumers were to be given freedom of choice. It was also stated in the letter that any application for permission to take the services into the houses and to pipe them would have to be in respect of individual houses and would be considered on its merits. That, said Counsel, was typical of the Corporation. In another letter from the Town Clerk, in February, 1936, the opinion was expressed that the tenant had no right to install gas piping in his house without the consent of the Corporation. Counsel wondered how tenants were to have freedom of choice under those conditions. When the Corporation knew that a very large number of the people who would live on the housing estates were accustomed to the use of gas and had said that they wanted it, it was unfair and improper to compel them to use electricity.

In recent years the ordinary price of gas supplied by the York Gas Company had been about 7·5d. per therm, and that entitled the Company to pay a dividend of £6 15s.% on the 4% standard dividend stock, under the terms of the sliding scale. But since 1926 the Company had paid a dividend of only 5%, believing in a policy of cheap gas and moderate dividends. Any additional costs incurred were borne by the consumers, and for that reason alone it was most undesirable that the Company should be driven to the cost of laying mains and carcassing houses after the houses were occupied. If the Corporation represented the citizens of York, the Company had claims upon them, for they were ratepayers and large employers of labour. Within the last 16 years the number of consumers had been increased from 21,000 to 28,000—an increase of 33%.

Dealing with an objection raised in the petition that the term "fittings," as used in the Bill, was very wide, and would enable the Company to place in the houses apparatus which might seriously affect the form of construction of those houses and the most economical design, so increasing the cost of construction and maintenance, Counsel said that it had been met by the insertion of a provision limiting "fittings" to include only joints, angles, clamps, connections, and other like things used in connection with the fixing of the pipes.

Commenting on a statement that in the past the Corporation had had difficulty in getting the Company to lay pipes, mains, and services, and that they had refused in some cases unless the Corporation made a substantial contribution to the cost, Counsel said that if the Housing Committee paid the Electricity Department to install wires, he did not see why they should not make a similar arrangement with the Gas Company in respect of piping; but in fact they did not pay the Company.

Mr. *H. E. Bloor*, B.Sc., B.Eng. (Engineer, Manager, Secretary, and a Director of the York Gas Company), gave evidence

in support of the Bill. He said that practically all the houses built by private builders in the Company's area of supply had been fitted during erection for the supply of gas. The number of houses connected to the supply during the period from 1928 to 1935 was 6,200. Until about 1927 or 1928 the Corporation had agreed to install a gas copper and gas fire, together with the necessary piping, in each house they had constructed, and they had paid the cost of so doing. Thereby he believed the Corporation had effected an economy, because at that time the only alternative to a gas copper was one which burned coal, and the cost of the gas apparatus was not greater than the cost of the coal fired copper. In recent years they had installed a good deal of electrical apparatus at their own expense, and the cost of electrical apparatus had exceeded anything that was necessary for gas. He agreed that 90% of the houses in York used gas for cooking, and in nearly 100% of the privately-built new houses in the area a gas copper was installed. The piping and the appliances installed were paid for by the builders. It was customary for the Gas Company, at their own expense, to extend the piping normally provided by the builders, so that the occupiers of the houses could use further appliances if they wished.

Mr. ASKEW (for the Company) commented, having regard to the Corporation's policy concerning gas appliances, that when a builder provided a stove for burning coal he did not ask the coal merchant to contribute towards its cost. The Gas Company, however, had asked to be allowed to make provision for a gas supply in the new housing estates without cost to the Corporation.

Mr. *Bloor* added that part of the extra cost involved in carcassing houses after they were occupied was due to the fact that the workmen had to be sent to the different houses at different times, whereas in the piping of the houses of an estate during construction the labour could be engaged on the work continuously until the carcassing of the whole of the houses was completed.

Referring to the result of the canvass of some prospective tenants of the Corporation's houses, when 138 of the 142 had wanted a gas supply, he said that three of the remainder had taken the rather interesting point of view that, as the Corporation were going to provide them with nice new houses, they felt it incumbent upon them to use whatever the Corporation desired them to use.

Replying to a question by Captain Peake (a member of the Committee) as to whether it was the Company's practice to ask consumers to sign an agreement to use gas for a period of years, Mr. Bloor said there were no such agreements. The Company's business was carried out on the principle that if they could not hold the business by service they did not want it; they would be embarrassed by an agreement which compelled people to take gas if they did not want it.

He had never known a builder to take objection to carcassing during construction; they always took the opposite view.

Estimates for Carcassing and Wiring.

Mr. NEEP, cross-examining, said that of the total of 3,676 houses owned by the Corporation, all of which were lit by electricity, 1,519 had each a gas copper, cooker, and fire, and 2,157 or thereabouts were all-electric. Each house had a coal cooking range, with a water heater at the back. He discussed details of various offers which had been made by the Company from time to time with regard to the provision of piping and apparatus, and secured admissions from Mr. Bloor that the Corporation had paid for piping in some cases, from 1920 onwards. He referred to estimates submitted by the Company in May, 1934, and gave the following quotations for the piping and the provision of a wash boiler and gas ring in houses and flats on an estate: For a flat, £3 9s. 7d.; for a two-bedroom house, £3 9s. 2d.; for a three-bedroom house, £3 17s.; for a four-bedroom house, £4 3s. In June, 1934, he said, the Corporation Electricity Department had quoted £3 5s. per house for installing a 10-gallon wash boiler and a 3-pint kettle, including the wiring. The Department had proposed to supply an electric breakfast cooker, and charges for current for all purposes, through prepayment meters, would be 1½d. per unit for the first 400 and 1d. per unit afterwards. Where a tenant required a full-size cooker the tariff would be 1½d. per unit for the first 700 and 1d. for further units. Those prices would include cooker rentals, and there would be no standing charge. He contended that the gas and electrical installations to which the prices related were comparable, and pointed out that the price for the electrical installation was definitely lower than any of the prices quoted by the Gas Company.

Mr. *Bloor* said that the quotation of the Electricity Department was formulated after the receipt of the Gas Company's prices, and the price quoted by the Electricity Department was very considerably less than the cost of the installations. He would very much like to know whether the difference had been added to the price quoted to the Housing Department by the Electricity Department in respect of the lighting equipment of the houses. The figure quoted by the Gas Company was an honest commercial figure, but the figure of £3 5s. quoted by the Electricity Department was not.

Mr. NEEP referred to six houses owned by the Company and occupied by their employees, and suggested that inasmuch as those houses were not wired for electricity, the occupiers had not freedom of choice as to whether they should use electricity or gas.

Mr. *Bloor* said they had never expressed a desire to use electricity, nor had the Electricity Department made an application to wire the houses free of charge! Had any of the tenants asked for permission to use electricity they would have received permission forthwith. When Counsel suggested to him that the Company had not considered it worth while to equip the houses for electricity, he said nobody would have expected the Gas Company to equip their own houses for electricity.

Mr. NEEP pointed out that, under the terms of the Bill the Company would be able to carcass the Corporation's houses for gas lighting, but none of the houses had gas lighting, and the Company, in correspondence with the Corporation, had not even asked to install gas lighting.

Mr. *Bloor* agreed, but he hoped Counsel would not use as evidence against the Company their efforts to show how reasonable they were.

In reply to a question as to the justification for extending the provisions of the Bill not only to houses but also to other buildings of which the whole or part were intended or adapted to be sold, leased, let, or otherwise disposed of, Mr. Bloor agreed that it would apply to public baths, recreation pavilions, and so on, if they were in process of alteration or conversion; he pointed out that exhibitions might be held in such buildings, and the Gas Company might be asked to give cooking demonstrations, so that a supply of gas was important.

Mr. NEEP said that, if a house were being altered or converted, which would give the Company power to carcass it, under the terms of the Bill, and if, by reason of the carcassing, a bedroom which previously had not been provided with a flue must be provided with a flue for a gas fire, it would entail extra cost. He asked whether that cost should be borne by the Company.

Mr. *Bloor* replied that it should be borne by the Corporation. He was encouraged to make that reply because, at an early stage, he had endeavoured to interest the Corporation in a system of providing, not a full-size flue such as would be required for a coal fire, but a flue appropriate for a gas fire. The Corporation had stated, however, that such a method of construction was not admissible, as they were advised that a full-size flue was necessary to health. It was of great interest, therefore, that they were now advised that a flue was not necessary.

The CHAIRMAN asked whether the houses which had been fitted for electricity only, and in which gas had been introduced subsequently, were fitted with flues.

Mr. *Bloor* replied that the houses were built during the era in which the Corporation had considered the provision of a flue to be necessary to health. Apparently they had been converted from that view lately.

Re-examined with regard to the Electricity Department quotation of £3 5s. for a wash boiler and kettle and the necessary wiring, Mr. Bloor said that a cooker would be provided, but it would not be free, for it involved a charge of an extra ½d. per unit for the first 400 units used per annum.

Evidence of Tenants.

Mrs. *Cross* (a tenant in one of the Corporation's houses on the Huntingdon Road Estate) said that the house was fitted for electric lighting and was equipped with a coal range, an electric washing copper, and a small electric breakfast cooker. She had not found the cooking so easy or satisfactory as by means of the gas cooker she had used in the house she had previously occupied. She had visited the Gas Company and had asked for a gas cooker, and had said that nearly all the people on the estate wished to use gas; they had tried electricity and were "fed up" with it. The Gas Company had stated that there was no gas supply available on the estate. She had then petitioned her neighbours, and had secured 139 signatures. Recently she had moved back into the City and was using gas, with which she could cook more satisfactorily and more cheaply than with electricity.

Cross-examined, witness said that she had moved back into the City, after living on the estate for about six months, because she could not get on with electricity, and it was too costly.

Mrs. *Robson* (a tenant on the Heworth Grange Estate) said she had occupied an all-electric house for four years, and had found that electricity was not convenient for cooking or washing. She cooked on the range in the living room, and not by electricity, and she boiled water on the fire instead of using the electric copper.

Mrs. *Woodcock* (a tenant on the Heworth Grange Estate) also said that the electric cooker was slow and that she would like a gas cooker. On one occasion the electric kettle had broken down, so that it was necessary to light the coal fire to prepare breakfast. Ordinarily, she used the coal range for cooking, for electricity was too expensive and too slow.

Mr. *D. Collins* and Mr. *W. Simpson* (builders and contractors, of York) both gave evidence with regard to the houses they had built for sale, and said it was their practice to carcass for gas during erection.

Mr. *C. W. Cashmore Needham*, F.R.I.B.A. (Architect and Town Planning Consultant, of York), said that since the war he had been concerned with the design and supervision of housing schemes for various local authorities and of houses provided by speculative builders. He had been Chief Architect in the Housing Department of the Leicester Corporation, and had been responsible for the design of more than 3,500 municipal houses there. The Corporation owned both gas and electricity undertakings, and had installed gas for cooking and electricity for lighting in every house. The tenants had been at liberty to use gas or electric fires, or electric cookers, but in almost every case gas cookers were preferred. In connection with housing schemes for rural district councils, he had found that wherever gas was available, provision was made for its use. Failure to pipe houses would make a great difference to the selling of

houses, and the only proper time at which to provide the piping was during construction.

Tuesday, May 12.

Mr. *Bloor* added to his evidence with regard to the results of canvassing tenants and prospective tenants of Corporation houses. With regard to the canvass made in 1935 of people who were living in houses that were to be demolished, and who were to occupy Corporation houses, when 138 of the 142 had given definite orders for gas appliances, he said that 76 of them (55%) had asked for gas lighting. In another canvass of people occupying Corporation houses, of whom 139 had given the Gas Company orders, 20 had asked to be provided with gas lighting, notwithstanding that the houses were provided with electric light. The fact that the percentage of people asking for gas lighting was materially less in the second case was probably due to the inconvenience which would arise from the piping of the houses during occupation.

Mr. NEEP (cross-examining) suggested that the people had asked for gas lighting after listening to the persuasion of the Company's canvasser.

Mr. *Bloor* replied that there was no persuasion; following a petition by the householders for gas, the canvasser was instructed merely to ask what apparatus they wanted. If he had devoted any time to persuasion he could not have completed the work so quickly as he had completed it.

Councillor Mrs. *Edna Crichton* (Chairman of the Housing Committee of the York Corporation) gave evidence against the Bill. In 1920, she said, the Committee had decided that the houses of the Corporation should be lit by electricity, for reasons of convenience to the tenant, cleanliness, health, and economy in decoration. Witness confirmed that between 1920 and 1923 the Corporation had not accepted some of the offers made by the Gas Company, but in some cases had bought gas apparatus and had paid for gas piping. Some 50-60% of the tenants of the estates were very poor people, many of the men being unemployed. The inclusive rent for a three-bedroom house (including City rate and water rate) was 7s. 9d. per week, and for a four-bedroom house, 6d. more. There was a differential scale of rents down to 4s. per week, some differentiation being made according to the means of the tenants.

Witness was questioned with regard to a statement by Mr. Bloor that an estimate of £3 5s. per house, by the Electricity Department, for the provision of a wash boiler and kettle, and the wiring, was not an honest commercial figure. It compared with figures ranging from £3 9s. 2d. to £4 3s. per house, according to size, for gas carcassing and the provision of a wash-boiler and gas ring. The date of the Gas Company's estimate was May 18, 1934, and that of the Electricity Department's estimate was June 11, 1934. Witness said that so far as she was aware, the tenders were opened in Committee in the usual way and considered by the Committee.

Mr. NEEP asked if there were any truth in the suggestion that the Electricity Department was aware of the Gas Company's estimate before it had submitted its own figure.

The CHAIRMAN, following a protest by Counsel for the Company, said that witness would not know anything about the details of the estimates; he had served on many committees of local authorities, and the officers of those authorities had to be trusted to say whether estimates were fair estimates.

Mr. TYLDESLEY JONES, K.C. (for the Company), suggested that Mr. Neep was trying to avoid calling the Electrical Engineer to give evidence.

The CHAIRMAN remarked that unless the witness was in the electrical or gas industry she could not say whether the estimates were honest commercial estimates.

Mr. NEEP said that, although witness could not speak in an absolutely first-hand way, he would have thought it proper to ask her whether she had any information to the contrary.

Witness, replying to Captain Peake (a member of the Committee), said she had become a member of the Electricity Committee recently. It was not the fact, as had been suggested, that an addition would be made to the £3 5s. to cover the cost of wiring for the lighting installation. She did not think there was any prejudice in favour of electricity.

Lighting and Freedom of Choice.

Cross-examined by Mr. Tyldesley Jones, who said that the people had to take what houses they could get, and who asked whether they should have choice, witness said it was reasonable that they should have choice in respect of the medium of heating and cooking, but it was not satisfactory that they should have with regard to lighting, in her opinion; they were not in a position to judge.

Mr. TYLDESLEY JONES asked if it were suggested that, although the people were entitled to exercise a vote for the choice of a Parliamentary candidate, they were not competent to choose the medium of lighting that they should use.

Witness replied that they had some experience of Parliamentary candidates, but no experience of electric lighting. [Laughter.] She added that the experience of those who had used electric light was of more value than the views of those who had not used it. She agreed that the tenants had no choice as to the medium of lighting, though, said Counsel, Parliament had said they should have.

The tenants on some of the estates had not choice in respect of the medium of cooking because there were no gas mains near them. When asked why, she said she supposed it was because it was not a paying proposition to provide them.

Mr. TYLDESLEY JONES asked if it were a paying proposition to provide electricity mains without payment from the Housing Department.

Witness thought not.

Mr. TYLDESLEY JONES, having ascertained that a boarding house in which witness was interested used gas for cooking and for heating bedrooms, commented that even so the tenants of the Corporation's houses had to use what was provided for them and had no choice.

Witness replied that the boarding house was a big house and she had not the capital necessary to convert it to the use of electricity, although she would have liked to have substituted electric cookers and heaters. The house in which she lived was smaller; it was originally fitted for gas but had been converted to an all-electric house.

Mr. TYLDESLEY JONES asked whether the Corporation refused the Company permission to carcass the houses for heating and cooking, at the Company's expense.

Witness replied that permission was refused for carcassing houses for lighting.

Mr. TYLDESLEY JONES asked if, since 1928, the Corporation had accepted a single offer by the Gas Company to provide gas pipes in the houses for heating and cooking.

Witness replied that she thought not.

Mr. TYLDESLEY JONES asked if the position was that the Housing Department paid for the wiring of the houses for electricity but refused to pay for the piping of the houses for gas cooking and heating; if a tenant wanted to use gas for cooking and heating, he or the Gas Company must pay for the piping.

Witness replied that the tenants had no choice because there were no gas mains available.

Mr. TYLDESLEY JONES replied that the Corporation had effectually brought about that position by refusing to allow the houses to be piped.

Gas and Electricity Tenders.

With regard to the tenders referred to, submitted by the Gas Company and the Electricity Department, Counsel said it was not the case that the Gas Company's tender was in a sealed envelope and was opened only in Committee. The offer was made in a letter from Mr. Bloor in the course of a long correspondence with the City Surveyor, and the letter bore the stamp of the City Engineer's office, stating that it was received on May 19. He quoted from a letter, written by the City Electrical Engineer to the Town Clerk, dated June 11, that of 109 tenants on one of the estates, 104 had applied for the installation of electric cookers, 4 were in abeyance, and one did not require a cooker. Thus, he said, before June 11 (the date of the Electricity Department tender), the Department was getting applications signed by the tenants who were in the houses. He asked whether the tenants were required to sign the agreements as a condition of securing the houses.

Witness replied that she knew they were not.

In the course of further reference to correspondence between the City Engineer, the Electrical Engineer, and the Town Clerk between the date of receipt of the Gas Company's tender and the date of the Electricity Department's tender, Counsel referred to a letter from the Town Clerk to the Electrical Engineer, to the effect that the Committee had been in communication with the Gas Company in connection with gas appliances, and that consideration of the matter had been deferred pending the submission of a report as to the number of electric cookers supplied to tenants on the estate in question. Thus, said Counsel, the Electrical Engineer had known that there had been communications between the Housing Committee and the Gas Company.

Witness said she had never asked whether the City Engineer had informed the Electrical Engineer of the Gas Company's offer.

COUNSEL said he had referred to the matter because aspersions had been cast on the propriety of Mr. Bloor's evidence.

Having ascertained that witness (as Chairman of the Housing Committee) had proposed in Council the motion to oppose the Company's Bill, and that there were 48 members of the Council, Mr. Tyldesley Jones said that a clear majority was necessary to enable the Corporation to oppose the Bill. The clear majority (25 votes) was obtained exactly. At the same time, anyone who had a share in the Gas Company or whose husband or wife had a share, was disqualified from voting. Even some of those who had no financial interest in the Gas Company were strenuously opposed to the Corporation opposing the Bill.

Mr. *Frank W. Spurr* (who was City Engineer and Surveyor at York until his retirement in July, 1935) also gave evidence with regard to the correspondence referred to.

(To be concluded.)

Meters, Ltd., Manchester

The Report of the Directors of Meters, Ltd., Manchester, for the year ended March 31, 1936, states that the net profit amounts to £20,781, which added to the balance of £6,760 brought forward, gives a total of £27,540. After deducting the interim dividends amounting to £6,671 paid in November last, the amount now available for appropriation is £20.869.

The Directors recommend the following: The payment of final dividends for the year ended March 31, 1936, of 2¾% (actual) upon the preference stock, and of 6½% (actual) upon the ordinary stock, making the total dividends for the year 5½% upon the preference stock and 9% upon the ordinary stock (both less income-tax). That the balance of £8,209 be carried forward to next year's accounts.

South-Eastern Gas Corporation, Ltd.

A Year of Steady Progress

The Fourth Ordinary General Meeting of the South-Eastern Gas Corporation, Ltd., was held on Wednesday, May 13, at the Registered Office, 84, Horseferry Road, London, S.W.

Sir DAVID MILNE-WATSON, LL.D., D.L., the Chairman of the Corporation, who presided, said the balance to net revenue account for the year was £93,051, as against £87,014; adding £10,080 brought forward, there was a total of £103,132. Deducting preference dividends for the year and the interim dividend of 3% paid in September last, there was available £41,935, from which the Directors recommended a final dividend of 3% on the Ordinary shares, making 6% for the year, and leaving £16,631 to be carried forward, as compared with £10,080.

Co-ordinated Selling Policy.

The Directors hoped to give special attention in the early future to the question of sales organization. The guiding principle would be that co-ordination and rationalization could be applied to the sales side of a group of Companies with as beneficial results as they could to purchasing and manufacture. The Board would take care to leave to the individual Companies proper opportunities for the exercise of individual initiative, but there was no doubt that a measure of guidance and inspiration from a central source, ensuring a degree of uniformity in the main lines of sales and publicity work, would be of great advantage. They had already seen that exemplified in a measure in the gas refrigerator campaign now in full swing. There was no doubt that not merely in the refrigeration market, but in other great fields that required either further exploitation or vigilant defence—the fields of space heating, water heating, and cooking—the adoption by the Industry as a whole of co-ordinated selling and advertising policies would be of enormous assistance, both on the score of efficiency and economy. That, it seemed to him, was the next great forward step that awaited the Industry. No doubt there were certain practical difficulties in the way, but difficulties were there to be overcome, and he looked forward most optimistically to a considerably enhanced rate of progress, not only for their own group of companies, but for the whole Industry once the necessary action was taken.

Gas Prices and Coal.

The Board had actually made reductions in the price of gas in five of their Companies, and would probably have done more if it had not been for the general increase in the price of coal, the present price of which was a serious matter for gas undertakings, and, indeed, for all public utility undertakings. There were, moreover, further developments in the coal situation which were of great importance. The Government had just introduced a new Coal Mines Bill. The object of Part I. of the Coal Mines Act of 1930, the operation of which was to be continued, was to permit of coal marketing schemes being introduced, but, unfortunately, there were two very grave defects. In the first place, it not only made no provision for eliminating inefficient pits, but, in fact, encouraged their survival by allotting to them a certain quota of the total production. In the second place, it contained no safeguard for consumers, though, when a monopoly of that kind had been granted in the past, it had always been considered an essential condition that the consumer should be protected. It was strongly to be hoped that the Government would amend existing legislation, so that consumers should be protected against any arbitrary fixing of prices or refusal to supply coal of the quality demanded.

He thought what he had said showed they were making steady progress in their aim of giving the consumer good service throughout the area they controlled.

The report and accounts were unanimously adopted.

South-Western Gas and Water Corporation, Ltd.

Further Substantial Progress

MR. S. J. INGRAM'S ADDRESS.

The Second Annual General Meeting of the South-Western Gas and Water Corporation, Ltd., was held at 9, Clement's Lane, London, E.C., on Friday, May 15.

The Representative of Messrs. Close Brothers, Ltd., the Secretaries, read the notice convening the Meeting and the Report of the Auditors.

Mr. S. J. INGRAM, M.Inst.Gas E. (the Chairman), in proposing the adoption of the report and accounts, said: Gentlemen,—The report of the Directors and statement of accounts for the past year have been in your hands for some days, and, I presume, it is your wish to take them as read. [Agreed.]

The issued capital has been increased during the year by 66,186 Preference shares and 14,471 Ordinary shares, upon which premiums amounting to £8,470 14s. 3d. were obtained. This amount has been used as to £6,274 8s. 1d. in wiping out the balance of "formation expenses," which you will be glad to see now disappears from the balance-sheet, and as to £1,100 in writing down investments in subsidiary companies, and the balance of £1,096 6s. 2d. has been transferred to revenue account.

The item "loan from subsidiary company" exemplifies our policy of co-ordinating cash resources, so that no subsidiary company is short of cash while another has idle money at its disposal. In this particular case one subsidiary was in temporary possession of surplus cash resources, while another was in temporary need of cash. Through the medium of the Corporation these resources were utilized to the advantage of both subsidiaries.

Investments in Subsidiary Companies.

On the other side of the balance-sheet "investments in subsidiary companies" have been increased by £68,054 4s. 6d., which represents the cost of the Gillingham Gas and Coke Company, the Castle Cary Gas and Coke Company, Ltd., the Tavistock Gas Light and Coke Company, Ltd., the Wedmore Gas Company, Ltd., and the Ottery St. Mary Gas Undertaking and some additional shares acquired in the other Companies we control. The book value of such investments has been reduced by an amount of £1,100 from premium account and £3,387 3s. from revenue account, which I will explain later.

The freehold property referred to represents substantial modern premises on an excellent site at Malmesbury. A portion of the ground floor of the premises is let to the Malmesbury Gas Company as showrooms, stores, and workshop.

The next item, "loans to subsidiary companies," shows an increase of about £45,000 compared with last year. The money has been applied in extensions of mains, redemption of loans, purchase of additional property, and other improvements. Your Board is satisfied that in each case the money has been wisely spent.

The next item, "formation and other expenses," you will note is now extinguished by the transfer of £6,274 8s. 1d. from premium account as already stated.

Revenue Account.

Turning to the revenue account, on the credit side you will see the item £3,387 3s. special bonus dividends, to which I have already referred, and if you look at the other side of the ac-

count you will see we have applied a similar amount in writing down the cost of investments. Your Directors considered it prudent to take this course, because these bonus dividends, although, of course, rightly declared out of revenue, are non recurring items and were not earned entirely during the past year.

Included also in the revenue account is the sum of £1,096 6s. 2d. drawn from premium account as previously mentioned.

The final balance available, after paying Preference dividends and the interim distribution of 2% on the Ordinary shares, amounts to £9,961 1s. 4d., out of which your Directors recommend the payment of a final dividend of 3% per annum, less tax, leaving £242 2s. 10d. to be carried forward.

Further Acquisitions Under Consideration.

I should like to point out that in the present state of development of the Corporation the ratio of expenses to revenue may appear high, but with the growth of the Corporation and the further acquisitions which the Directors are at the moment in active negotiation for, this ratio will be reduced substantially with a consequent improvement in net profit. Some of you may possibly be wondering why we have not acquired a larger number of undertakings than we have during the past year. During our first year we acquired 23 gas and water undertakings and considerable time and energy were, therefore necessary to improve and co-ordinate them. This has been our major task during the past year.

Further, I think you are aware that in recent months there has been some slight reaction in the price of most gas stocks. On the other hand, Directors and shareholders of many gas undertakings, whose companies would undoubtedly have profited by linking up with other undertakings on reasonable terms, have valued their interests at such excessive amounts that acquisition on these terms would have been neither reasonable nor economic, unless possibly to the vendors.

And here I am tempted to utter a word of caution to those undertakings who are not at present associated with holding companies or similar groups. Although I am convinced increasingly of the necessity for, and the ultimate success of co-ordination and co-operation in the Gas Industry, the tendency for undertakings to demand grossly inflated prices for their shares on amalgamation with, or sale to, holding companies or similar groups can only hamper the prosperity of these organizations and is not in the interests of either the Gas Industry as a whole or of the consumers. Such transactions only mean that the major share of the profit remains with those who had withdrawn their capital from the Gas Industry. I need scarcely say that this Corporation has resolutely set its face against acquiring interests in any undertaking on other than what they believe to be economic terms.

Smaller Undertakings' Progress.

And now I expect you would wish me to say something of the progress we have already made with the undertakings under our control. Briefly, I may say that these results, incomplete as they are, have already exceeded our expectations. In the case of the larger undertakings we naturally expected, and have realized, very satisfactory increases of business, but with the smaller undertakings, who have felt keenly the strain of competition during the past few years, there has come a decided revival of business. Not only have we arrested the decline in output, but in every case there has been a decided increase of sales, in many cases as much as 20%.

In this competitive age with Press and Government-inspired propaganda, in many small undertakings it has been indeed difficult to carry on, and the local staff had lost heart and developed an "inferiority complex." In those cases where this Corporation has obtained control by advice and the introduction of new methods of manufacture and improved service the confidence of the consumer has been regained, and a new era of prosperity has been opened up for the undertakings.

Widespread Developments.

In consequence of the uncertainty of trade many of our subsidiaries during the past years had not felt disposed to embark on expenditure for the acquisition of new business, and as a consequence much business had been lost to their competitors. Since their connection with us this problem has been constantly under review, and by advice and the provision of the necessary loans we have made it possible for them to carry out these developments, notably at that popular North Cornwall seaside resort, Bude; at Padstow, where Trevone has been provided with a gas supply; an extension of mains to St. Austell Bay and an extension of mains at Dursley. Shaftesbury and Gillingham (Dorset), undertakings which are only four miles distant, have also received attention.

The works at Gillingham have been enlarged and the mains extended to the holders at Shaftesbury. In a week or two's time manufacture of gas will be concentrated at Gillingham and a very valuable site released at Shaftesbury. This will result in considerable economy in manufacture and administration.

The Directors have been aware that in the past sufficient attention has not been paid to salesmanship and service. These defects are in process of being remedied throughout our subsidiaries by means of propaganda, trained canvassers, opening of showrooms, &c., with excellent results. So far, with the assistance of the Corporation, five additional showrooms, with modern equipment, have been provided among our undertakings.

Service to Subsidiaries.

The Corporation has also by its organization been of great service to its subsidiaries in the matter of purchases of coal, oil, tubes, stoves, and other requirements. Particularly has this been marked in the purchase of coal. By organizing the transport, such as shipment to convenient ports in large steamers or motor-vessels, and redistributing to neighbouring undertakings, it has been possible to effect considerable savings in the cost of coal; the whole of these economies on this and other purchases have been transferred without deduction to the undertakings affected.

At an early date the Directors became aware of the real need of scientific control of manufacture and the examination of materials employed at our various works. In most of our works it is impossible to provide a properly equipped laboratory This has now been set up at Dorchester with a fully trained chemist in charge. To this laboratory are sent samples for analysis from any of our subsidiaries, and the advice of the chemist is available at any time to any of our managers, and when necessary the chemist pays a visit to the local undertaking.

Our water companies have enjoyed considerable prosperity, and in spite of the drought there was no necessity for any restriction of supplies. There is no doubt that their association with us has been of great benefit to them.

All these changes and improvements, however, could not have been carried out without the loyal co-operation of our various staffs, and I am glad to say that we have been and are served excellently in this direction.

Board's Successful Policy.

We have introduced the policy of associating our smaller undertakings, under the charge of a young well-trained gas engineer, with a neighbouring larger undertaking. This policy has proved most successful, and we have now on our staff a number of keen and capable young men who will no doubt prove of great value to us in our future development.

In looking back, therefore, over the work of the past two years, notwithstanding its strenuous nature, I see every cause for encouragement. In this pioneer work, Mr. H. G. Palmer, who brought to the Board a wealth of experience, rendered to the Corporation excellent service, and his severance from the Board is a matter of very sincere regret to his late colleagues there. The choice of a suitable successor to Mr. Palmer was a most difficult task, but I think we are all agreed that the Corporation are to be congratulated that Sir Francis Goodenough, an outstanding figure in the Gas Industry, has accepted the invitation of the Board to join them as its Deputy-Chairman. [Applause.]

The report and accounts were unanimously adopted and the dividends recommended were approved.

The Director retiring by rotation, Mr. C. Holmes Hunt, M.A., was re-elected.

Election of Sir Francis Goodenough.

The CHAIRMAN: Gentlemen,—We very much regret that Mr. Palmer by reason of ill-health has felt it necessary to sever his connection with the Board, and I think we are exceedingly fortunate that Sir Francis Goodenough has consented that his name should come before this meeting as a successor to Mr. Palmer. We should have been exceedingly glad if Sir Francis had come on as Chairman, but at any rate we have his promise that when he is eased of some other offices and when his health is still more assured he will occupy the position of Chairman of the Board of Directors, and I shall be very glad indeed to serve under him as I have in committees.

The CHAIRMAN then proposed the election of Sir Francis Goodenough, C.B.E., as a Director, which was seconded by Mr. C. L. ROSEWARNE, and carried unanimously.

Sir Francis Goodenough's Remarks.

Sir FRANCIS GOODENOUGH: Mr. Ingram and Gentlemen,—I should like to say with what pleasure I accept a Directorship on the Board of the South-Western Gas and Water Corporation. I have reasons for being particularly pleased; one is that yesterday I completed 48 years' service in the Gas Industry; I start to-day on my forty-ninth year since I left the West Country for London and commenced service with the Gas Light and Coke Company as a junior clerk, and it is, therefore, rather nice that to-day I should be elected to the Gas Corporation which supplies the districts with which I am associated by birth.

You, Sir, have indicated verbally to me the policy of this Corporation, and in your speech to-day you have confirmed many of the particulars that you gave me, and I can say that the policy which has been followed by this Board is one with which I am in entire sympathy, and I hope to be of assistance in carrying it out in the future. You have shown courage, foresight, and capacity for progress in a very unusual degree, and I am very glad indeed to be associated with you, and hope I shall be able to be of some service to you. [Applause.]

The Auditors, Messrs. Deloitte, Plender, Griffiths, & Co., were reappointed and the proceedings then terminated.

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THE Stanton-Wilson Self-adjusting Pipe-joint enables gas mains to withstand ground subsidence and traffic vibration. Being leaktight under pressure, it is particularly suitable for mains in gas supply systems. Well over 300,000 Stanton-Wilson Joints are now actually in service.

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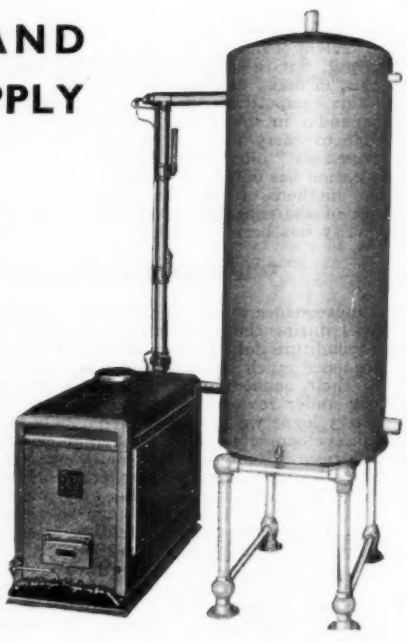

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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

The Stock Exchange led a somewhat humdrum existence last week, for with the international situation continuing unchanged many investors are still pursuing a "wait and see" policy. Business therefore was confined to comparatively few securities, the only feature of note being the heavy speculative buying of the two Eagle companies' shares and "West Wits," all of which closed substantially higher. Gilt-edged stocks remained steady, but home rails weakened on the disagreement over the wages question. There were no items of interest in the industrial section, which on the whole presented a drooping tendency.

The Gas Market fared perhaps a trifle better than some of the other sections for the volume of business, though less than the previous week, was well up to the average and prices remained firm. The quotations at all the Exchanges continued unchanged with the exception of two increases in London—viz., Montevideo and South-Western Gas 4% debenture, both of which gained 2 points.

The Directors of Associated Gas and Water Undertakings have declared a final dividend on the ordinary shares of 2½%, making 5% for the year, the same rate as that paid for the period from December, 1933, to March, 1935.

To the genuine permanent investor who is on the look-out for something better than the meagre return on gilt-edged securities, with comparative safety, the Gas Market continues to offer a good outlet. The table below gives the yield at the current middle market price on twenty of the leading ordinary stocks, the average return being about £4 8s. 5d.%, and it will be noticed that several appear to be undervalued. For instance, the yield on the Portsmouth stock of £4 15s. 8d. is a high one having regard to the Company's dividend reputation and its recent acquisition of the Gosport Company, for the latter undertaking had more than doubled its output in the previous ten years, and the further opportunities for expansion thus afforded the parent company should prove distinctly advantageous. Another example is that of the British Gas Light Company with a yield of £4 13s. 5d.%. This Company has distributed a dividend of 7½% for many years past, and the stock reached a price of 178½ last year.

—	Last Annual Dividend.	Present Price.	Yield %.
	%		£ s. d.
Alliance and Dublin	£7 6s. 3d.	155	4 14 3
Bournemouth 7%	7	172½	4 1 2
Brighton 5%	6⅜	157½	4 5 9
Bristol	5	121	4 2 7
British	7½	160½	4 13 5
Cardiff	6	132½	4 10 6
Commercial	5	99½	5 0 6
Croydon sliding-scale	7	160½	4 7 2
Derby	8½	181	4 13 11
Gas Light units	£5 12s.	28s. 3d.	3 19 1
Liverpool	6	136	4 8 2
Newcastle units	£5 7s. 6d.	26s.	4 2 8
Portsmouth	8¼	172½	4 15 8
Sheffield	6	148½	4 0 9
South-Eastern Corporation	6	27s.	4 9 0
South Metropolitan	5⅝	125½	4 11 7
South Suburban	6	133½	4 9 10
Southampton	5	115½	4 6 6
Tottenham	6⅜	151½	4 9 1
Wandsworth	7	160½	4 7 2

Current Sales of Gas Products

The London Market for Tar Products.

LONDON, *May* 18.

There are no changes to report in the prices of tar products, which remain as follows:

Pitch, about 37s. 6d. per ton f.o.b.

Creosote, 5⅛d. per gallon.

Refined tar, 3¾d. per gallon in bulk at makers' works.

Pure toluole, about 2s. 7d.; pure benzole, 1s. 7d. to 1s. 8d.; 95/160 solvent naphtha, about 1s. 8d.; and 90/160 pyridine, about 4s. 3d. to 4s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

May 18.

The average prices of gas-works products during the week were: Gas-works tar, 20s. 3d. to 25s. 3d. Pitch—East Coast, 35s. to 37s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 35s. to 37s. 6d.* Toluole, naked, North, 2s. 2d. to 2s. 4d. Coal-tar crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 6d. to 1s. 6½d. Heavy naphtha, North, 1s. 1d. to 1s. 2d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅜d. to 4⅝d.; low gravity, 4⅝d. to 4¾d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 2s. 4d. to 2s. 6d. Naphthalene, £24 to £26. Salts, 100s. to 105s., bags included. Anthracene "A" quality, 3d. to 3½d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *May* 16.

There is still difficulty in securing the finer products and prices of these are therefore more or less nominal.

Crude gas-works tar.—The actual value is 34s. to 35s. per ton *ex* works in bulk.

Pitch.—Quotations remain unaltered at 35s. to 37s. 6d. per ton f.o.b. Glasgow for export, and 35s. per ton *ex* works in bulk for home trade.

Refined tar.—Quite considerable quantities are changing hands at 3¾d. to 4d. per gallon *ex* works in buyers' packages for home trade, and 3d. to 3¼d. per gallon f.o.r. for export.

Creosote oil.—The balance between production and demand is about equal and prices are therefore steady. B.E.S.A. Specification, 5¼d. to 5⅜d. per gallon; low gravity, 5¼d. to 5½d. per gallon; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—Supplies are most difficult to secure and the following can only be taken as approximate values if quantities were available. Pale, 97/99%, 1s. 10d. to 1s. 11d. per gallon; dark, 97/99%, 1s. 8d. to 1s. 9d. per gallon; pale, 99/100%, 2s. 1d. to 2s. 4d. per gallon; all *ex* works naked.

Crude naphtha.—Production is still on the short side and value remains steady at 5¼d. to 5⅜d. per gallon, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 5½d. to 1s. 6½d. per gallon, and 90/190 heavy naphtha is 1s. 1d. to 1s. 2d. per gallon.

Motor benzole is available in small quantities at 1s. 3½d. to 1s. 4d. per gallon.

Pyridines.—90/160 grade is 5s. to 5s. 6d. per gallon, and 90/140 grade is 5s. 6d. to 6s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 8½	to	0 9	per gallon at works
Motor "	1 2	"	1 2½	" " "
90% "	1 3	"	1 3½	" " "
Pure "	1 7	"	1 7½	" " "

Contracts Advertised To-Day

Coal.
- Abertillery Urban District Council. [p. 544.]
- Droitwich Gas Department. [p. 544.]
- Gainsborough Gas Department. [p. 543.]
- Nantwich Gas Department. [p. 544.]
- Skipton Gas Department. [p. 544.]
- Sutton-in-Ashfield Urban District Council. [p. 543.]
- Wallasey Gas Department. [p. 544.]

Gasholder Removal and Replacement.
- Glasgow Gas Department. [p. 543.]

Lighting Goods, Mantles, &c.
- Sutton-in-Ashfield Urban District Council. [p. 543.]

Lime.
- Mansfield Gas Department. [p. 543.]

Meters (New and Repairs).
- Mansfield Gas Department. [p. 543.]

Oils.
- Sutton-in-Ashfield Urban District Council. [p. 543.]

Pipes, Tubes, &c.
- Sutton-in-Ashfield Urban District Council. [p. 543.]

Retorts.
- Ripon Gas Department. [p. 544.]
- Sutton-in-Ashfield Urban District Council. [p. 543.]

Trade Notes

Vibrating Screens.

A new booklet has been published recently by Messrs. Pegsons, Ltd., of Coalville, Leicestershire, dealing with the Pegson-Telsmith heavy-duty screen which has been specially designed for screening such materials as sand, gravel, crushed stone, coal, and coke. The booklet, which is amply illustrated, gives pictorial examples of Pegson plant up and down the country.

British Aluminium Company Open Bristol Branch.

The British Aluminium Company, Ltd., have opened a branch office and warehouse at Rose Street, Temple, Bristol, 1 (Telephone No. 21747), under the management of Mr. O. Halliwell. At this warehouse the Company will hold stocks of their standard products—*i.e.*, aluminium and its alloys in crude and semi-manufactured forms, including ingots, notched bars, sheets, tubes, and sections.

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STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations May 15.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,767,439	Stk.	Mar. 16	7	7⅛	Alliance & Dublin Ord. ...	150—160	...	...
374,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb. ...	95—100	...	...
557,655	,,	Feb. 17	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	Mar. 30	1·4½	1·9⅜	Bombay, Ltd.	1¼—1⅜	...	26/6
179,305	Stk.	Mar. 2	9½	9½	Bournemouth sliding scale ...	218—228	...	...
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	170—175	...	172½—174
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	148—153	...	150
50,000	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	85—90	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	105—110	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
357,900	,,	Feb. 17	7½	7½	Brighton, &c., 6 p.c. Con. ...	170—175	...	...
649,955	,,	,,	6½	6½	Do. 5 p.c. Con. ...	155—160	...	157½—159
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	144—149	...	...
855,000	,,	Mar. 2	7	8	British Ord.	158—163	...	163
100,000	,,	Dec. 16	7	7	Do. 7 p.c. Pref.	153—158	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	96—101	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
200,000	,,	,,	17/6§	3½	Do. 3½ p.c. Red. Deb. ...	98—100	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	...
150,000	Stk.	Jan. 6	4½	4½	Do. 4½ p.c. Deb. ...	81—86	...	...
626,860	,,	Feb. 3	6	6	Cardiff Con. Ord.	130—135	...	...
237,860	,,	Dec. 16	5	5	Do. 5 p.c. Red. Deb.	110—115	...	...
98,936	1	Apl. 20	2/-	2/-	Colombo, Ltd., Ord.... ...	1⅜—1⅝*	...	...
24,500	1	,,	1·4½	1·4½	Do. 7 p.c. Pref. ...	20/—22/-	...	...
609,204	1	Mar. 30	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	18/6—20/6	...	...
296,053	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref	22/6—24/6	...	...
1,775,005	Stk.	Feb. 3	5	5	Commercial Ord.	97—102	...	97½—99⅜
620,000	,,	Dec. 2	3	3	Do. 3 p.c. Deb. ...	85—90	...	86—87
286,314	,,	Feb. 17	5	5	Do. 5 p.c. Deb. ...	120—125	...	123
807,560	,,	,,	7	7	Croydon sliding scale ...	158—163	...	162½
644,590	,,	,,	5	5	Do. max. div.	114—119	...	117½—119
620,385	,,	Dec. 16	5	5	Do. 5 p.c. Deb.... ...	121—126	...	...
239,000	,,	Feb. 3	5	5	East Hull Ord. 5 p.c.... ...	107—110	...	107½—109
184,555	,,	Feb. 17	6	6	East Surrey Ord. 5 p.c. ...	130—135	...	...
176,211	,,	Dec. 16	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
19,284,128	,,	Feb. 3	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	27.9—28.9a	...	28/—28/6
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.... ...	90—93	...	91—92⅜
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	105—108	...	107—108
8,602,497	,,	Dec. 2	3	3	Do. 3 p.c. Con. Deb. ...	87—92	...	88½—90
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	117—120	...	118½—119⅜
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	...	115½—116⅝
270,466	,,	Feb. 17	6	6	Harrogate New Cons. ...	130—135	...	...
157,500	1	Mar. 16	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅞—1 15/16	...	24/6—25/-
213,200	Stk.	Mar. 2	6	6	Hornsey Con. 3½ p.c. ...	135—140	...	...
5,600,000	,,	Nov. 4	14	8	Imperial Continental Cap. ...	157—167	...	160—168
223,130	,,	Jan. 20	3½	3½	Do. 3½ p.c. Red. Debs.	92—97	...	...
285,242	,,	Feb. 17	8½	8½	Lea Bridge 5 p.c. Ord. ...	175—180	...	177
165,736	,,	Mar. 16	8	10	Maidstone 5 p.c. Cap. ...	180—190	...	...
63,480	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	80—85	...	...
75,000	,,	Dec. 2	†10	†10	Malta & Mediterranean ...	200—210	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	102—107	...	...
231,978	Stk.	Feb. 17	5	5	M.S. Utility 'C' Cons. ...	110—115	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	102—107	...	...
360,075	,,	Dec. 16	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	123—128	...	...
125,000	—	Jan. 2	3½	3½	Do. 3½ p.c. Rd. Rg. Bds.	96—99	...	...
675,000	Stk.	Nov. 18	†3	†3	Montevideo, Ltd.	69—74	+2	70—72½
225,000	,,	Feb. 17	7½	7½	North Middlesex 6 p.c. Con.	169—174	...	170½
396,160	,,	Feb. 3	5	5	Northampton 5 p.c. max. ...	108—113	...	...
300,000	,,	Apl. 20	†9	†7	Oriental, Ltd....	165—170	...	168½
416,617	,,	Dec. 16	8	8	Plymouth & Stonehouse 5 p.c.	166—171	...	...
504,416	,,	Feb. 3	8½	8½	Portsmouth & Gosport Cons.	170—175	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	108—113	...	...
114,000	,,	Feb. 3	5	5	Preston 5 p.c. Pref.	110—115	...	...
355,698	1	Apl. 20	1/-	1/-	Severn Val. Gas Cor. Ld. Ord.	20.6—22/6	...	22/—22/6
454,510	1	Mar. 16	-/10⅜	-/10⅜	,, ,, ,, 4½ p.c. Cum. Pref.	21/—23/-	...	22/3
133,201	Stk.	Feb. 17	8½	5	Shrewsbury 5 p.c. Ord. ...	147—152	...	...
90,000	10	27 May '35	†3	†3½	South African...	3¼—4¼	...	...
1,106,173	1	May 4	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	26/—28 -*	...	27/—27/6
845,511	1	Mar. 16	-/10⅜	-/10⅜	Do. 4½ p.c. Red. Cum. Pref.	21/—23/-	...	21/9—22/-
200,000	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	20.9—21/9	...	...
450,000	Stk.	Feb. 17	4	4	Do. 4 p.c. Red. Deb. ...	101—104	...	...
6,709,895	,,	Feb. 3	5	6⅜	South Met. Ord.	124—127	...	124½—126½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf....	145—150	...	147—148¾
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf....	104—107	...	104½
1,895,445	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	88—91	...	88—89½
1,000,000	,,	Jan. 6	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
1,543,795	,,	Feb. 3	6	6	South Suburban Ord. 5 p.c....	131—136	...	133—134½
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	122—127	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	103—108	...	...
888,587	,,	Dec. 16	5	5	Do. 5 p.c. Deb....	123—128	...	...
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	104—109	...	...
427,859	1	May 4	9⅜	1/2⅜	S. Western Gas & Watar Ord.	22/6—23/6*	...	22/6—22/7½
160,523	1	Apl. 20	...	-/10⅜	Do. 4½% Red. Cum. Pref.	21/9—22/9	...	...
110,000	Stk.	Dec. 16	4	4	Do. 4% Red. Deb. ...	100—105	+2	105
647,740	,,	Feb. 3	5	5	Southampt'n Ord. 5 p.c. max.	113—118	...	115—117½
121,275	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	98—103	...	...
350,000	,,	Feb. 3	5½	5½	Swansea 5½ p.c. Red. Pref. ...	111—116	...	113½
106,000	,,	Dec. 16	6½	6½	Do. 6½ p.c. Red. Deb. ...	96—101	...	...
94,000	,,	...	...	...	Do. 3½ p.c. Red. Deb. ...	96—101	...	...
1,076,490	,,	Feb. 17	6⅔	6⅔	Tottenham and District Ord.	149—154	...	153
409,835	,,	,,	5⅔	5⅔	Do. 5½ p.c. Pref....	130—135	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	122—127	...	...
371,850	,,	Dec. 2	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
369,774	,,	Feb. 3	7	7	Uxbridge, &c., 5 p.c. ...	153—158	...	154—156
108,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	122—127	...	...
1,340,521	,,	Feb. 3	7	7	Wandsworth Consolidated ...	158—163	...	162
1,371,373	,,	,,	5	5	Do. 5 p.c. Pref. ...	122—127	...	125½
1,317,964	,,	Dec. 16	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
338,300	,,	,,	4	4	Do. 4 p.c. Deb. ...	104—109	...	...
499,735	,,	Feb. 17	6¾	7¼	Watford and St. Albans Ord.	155—160	...	157—158
200,000	,,	,,	5*	5*	Do. 5 p.c. Pref. ...	120—125	...	121
200,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	133—138	...	...
200,000	,,	Dec. 2	4	4	Do. 4 p.c. Red. Deb.	100—105	...	...
100,000	,,	,,	...	3½	Do. 3½ p.c. Red. Deb.	96—101	...	...
158,400	,,	Mar. 2	5	6b	Winchester W. & G. 5 p.c. Con.	115—120	...	...

a.—The quotation is per £1 of Stock. b.—Paid £3, including 10s. on account of back dividends. * Ex div.
† Paid free of income-tax. ‡ For year. § Actual for three months.

Stock and Share List continued overleaf.

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STOCK AND SHARE LIST—Cont.

Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. May 15.	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	Feb. 3	5	6	Bath Cons.	124—126	...	...
1,667,250	,,	Feb. 17	5	5	Bristol, 5 p.c. max.	120—122	...	...
120,420	,,	Dec. 16	4	4	Do. 1st 4 p.c. Deb. ...	103—105	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	103—105	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	125—128	...	...
274,000	,,	Feb. 17	5	5	Newport (Mon.) 5 p.c. max....	111—116	...	...
13,200	12	Mar. 16	7	8½	Pontyp'l Gas & W. 10 p.c. 'A.'	14—15	...	...
13,600	10	,,	5	6	Do. 7 p.c. B.'	11½—12	...	...
40,000	10	,,	5	6	Do. 7 p.c. 'C.'	11½—12	...	...
140,778	Stk.	Feb. 17	5	5	Weston-super-Mare Cons. ...	113—115	...	...
64,338	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	98—100	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	165—169	...	...
LIVERPOOL EXCHANGE.								
137,150	Stk.	Feb. 3	5	6½	Chester 5 p.c. Ord.	109—114	...	...
92,500	,,	Dec. 16	4	4	Do. 4 p.c. Pref.	100—105	...	...
32,540	,,	,,	3½	3½	Do. 3½ p.c. Deb. ...	91—96	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	100—105	...	...
2,167,410	,,	Feb. 17	6	6	Liverpool 5 p.c. Ord. ...	135—137	...	136
245,500	,,	Dec. 16	5	5	Do. 5 p.c. Red. Pref. ...	103—108	...	107
306,083	,,	Jan. 6	4	4	Do. 4 p.c. Deb. ...	105—107	...	...
106,280	,,	Feb. 3	10	10	Preston 'A' 10 p.c. ...	202—212	...	...
189,219	,,	,,	7	7	Do. 'B' 7 p.c.	140—153	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Mar. 2	8	8	Blyth 5 p.c. Ord.	154—156	...	...
732,000	,,	Feb. 3	5	5	Hartlepool G. & W. Co. & New	117—119	...	...
2,061,315	,,	Feb. 3	5	5½	Newcastle & Gateshead Con.	25/9—26/3a	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	106½—107½	...	...
776,706	,,	Dec. 16	3½	3½	Do. 3½ p.c. Deb. ...	100½—101½	...	...
277,285	,,	May 4	5	5	Do. 5 p.c. Deb. '43...	103—104*	...	...
209,820	,,	Mar. 2	8½	8½	South Shields Con.	169—171	...	...
299,542	,,	Feb. 3	6	6	Sunderland 6 p.c. max. ...	129—131	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Feb. 17	7	10	Derby Con.	176—186	...	...
55,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	175—185	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	130—140	...	...
20,000	10	Dec 16	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Feb. 17	10	10	Great Grimsby 'A' Ord. ...	220—230	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	220—230	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—215	...	...
1,806,339	,,	Feb. 17	6	6	Sheffield Cons.	147—150	...	...
95,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb.... ...	100½—102½	...	...

a The quotation is per £1 of Stock.

Supplementary List of Stocks and Shares not Officially Quoted

202,152	Stk.	...	...	...	Ascot Ord.	119—124	...	...
128,182	,,	...	...	...	Do. 5 p.c. Pref.	117—122	...	...
238,631	1	Nov. 4	5	5	Assd. Gas and Water Ord....	21/—23/-	...	...
323,681	1	,,	4½	4½	Do. 4½ p.c. Cum. Pref. ...	22/—23/-	...	...
150,000	Stk.	...	...	...	Do. 3½ p.c. Red. Deb. ...	...	...	100¾—101
17,000	,,	Feb. 17	8	8	Bognor Orig. Ord. 'A' ...	175—185	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	172—185	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	145—150	...	...
37,440	,,	Feb. 3	10	10	Cam.Univ. & Town 10 p.c.max.	210—220	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	158—163	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	108—113	...	...
65,000	,,	Mar. 2	7½	8¼	Eastbourne 'A' 5 p.c. ...	160—165	...	...
198,000	,,	,,	6	7	Do. 'B' 3½ p.c.	133—138	...	...
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	120—125	...	...
130,000	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	122—127	...	...
250,000	1	Nov. 18	...	4	Gas Consolidation Ord. ...	20/6—22/6	...	...
250,000	1	,,	...	4	Do. 4 p.c. Red. Cum. Pref.	19/6—20/6	...	19/4½—20/-
700,000	Stk.	...	...	...	Gas Light & Coke 3½ p.c. Rd. Db	102—104	...	103¾—104
24,000	30	Feb. 3	8½	8½	Great Yarmouth 8½ p.c. max.	52—57	...	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.... ...	42—45	...	...
51,160	Stk.	Dec. 2	5½	5½	Do. 5½ p.c. Deb.... ...	123—128	...	...
152,600	,,	Mar. 2	8	8	Guildford Cons.	185—195	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	114—119	...	...
68,250	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	120—125	...	...
156,600	,,	Feb. 3	7½	7½	Hampton Court Cons. ...	167—177	...	...
81,660	10	Feb 4,'35	5	9	Leatherhead Ord.	16—17	...	...
107,960	10	Mar. 16	4	5½	Mid Kent Ord.	10—11	...	...
230,940	Stk.	Feb. 17	10	10	Oxford & District Ord. ...	205—215	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	113—118	...	...
126,193	,,	Nov. 18	7½	7½	Peterborough Ord.	160—170	...	...
64,990	,,	Mar. 16	7½	7½	Redditch Ord.	113—118	...	...
166,850	,,	Feb. 17	7	9	Romford Ord.	170—180	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Mar. 16	5	5	Do. 5 p.c. Deb.	120—125	...	...
10,950	,,	Mar. 2	8	8	Ryde Ord.	165—170	...	...
136,191	,,	Feb. 3	5	7	Scarborough Ord.	128—138	...	...
27,825	,,	Feb. 3	8	8	Shanklin & Ventnor Cons. ...	152—162	...	...
40,643	,,	Mar. 2	7	7	Slough Ord.	147—152	...	...
221,000	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	116—121	...	...
28,872	1	May 4	5½	5½	S. Midland Gas Cpn.Ltd. Ord.	20/—22/-*	...	...
28,866	1	Mar. 16	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/6—21/6	...	...
137,...	...	eb. 17	7	7	Southgate & Dist. 7 p.c. max.	148—153	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	115—120	...	...
117,228	,,	Mar. 2	5	6	Swindon Cons.	111—116	...	...
60,425	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	122—127	...	...
50,000	1	Mar. 30	...	5·52d.	a Utd. Kingdom Gas Cpn. Ord.	20/6—22/6	...	21/—21/7½
760,910	1	,,	2½	2½	Do. 4½ p.c. Prefd. Ord....	20/—22/-	...	...
110,910	1	,,	...	2½	Do. 4½ p.c. Cum. Pref. ...	21/—23/-	...	22/3
900,000	Stk.	Mar. 16	...	3½	Do. 3½ p.c. Red. Deb. ...	98—101	...	...
130,000	,,	Feb. 3	5	8	Wakefield Ord.	140—145	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	105—110	...	...
500,000	,,	...	...	...	Wandsworth 4 p.c. Pref. ...	104½—106½	...	105¾
82,000	,,	Feb. 3	6	6	Weymouth Ord.	106—111	...	...
98,384	,,	Feb. 3	6	6	Wolverhampton 6 p.c. Pref.	127—132	...	...
160,000	,,	Dec. 16	5½	5½	Do. 5½ p.c. Rd. Db	107—112	...	...
370,000	,,	Feb. 3	4	6	York Cons.	108—113	...	...
90,000	,,	Dec. 16	5	5	Do. 5 p.c. Red. Deb. ...	103—108	...	...
133,640	,,	Feb. 3	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	127—132	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	115—120	...	116½
35,000	,,	Dec. 16	5½	5½	Do. 5½ p.c. Deb.... ...	130—135	...	...

a Actual.

NEW ISSUE.

SHORT PARTICULARS ONLY.

By Order of the Directors.

THE STONE GAS LIGHT AND COKE COMPANY, LTD.

The COMPANY OFFER FOR SALE BY TENDER upon the terms of the full Prospectus, dated 18th May, 1936,

1,600

FIVE PER CENT. NON-CUMULATIVE SECOND PREFERENCE SHARES OF £5 EACH.

Minimum Price of Issue, £5 per Share.

Copies of the full Prospectus containing Particulars and Conditions of Sale and Form of Tender (which must be sent in so as to be received not later than Twelve o'clock noon on Saturday, the 6th day of June, 1936) may be obtained from the SECRETARY, THE STONE GAS LIGHT AND COKE COMPANY, LTD., CROWN STREET, STONE, STAFFS.; Messrs. PADDOCK, SON, & ORME, SOLICITORS, 3, PALL MALL, HANLEY, STOKE-ON-TRENT; Messrs. WRIGHT & WESTHEAD, CHARTERED ACCOUNTANTS, 1, MARTIN STREET, STAFFORD; or MIDLAND BANK, LTD., STONE, STAFFS.

COMPANY NOTICES.

THE GAS LIGHT AND COKE COMPANY.

3 % CONSOLIDATED DEBENTURE STOCK.
4½% REDEEMABLE DEBENTURE STOCK.
5 % REDEEMABLE DEBENTURE STOCK.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, so far as they relate to the above-mentioned Debenture Stocks, WILL BE CLOSED at 12.30 o'clock p.m. on Saturday, the 30th instant, for the half-year ending on the 30th proximo, and will be RE-OPENED on the morning of Tuesday, the 2nd proximo.

The Interest for the half-year will be remitted by Warrant forwarded by post on the 30th June next to the Proprietors registered on the Closing of the Books or their authorized Agents.

By order,
WILLIAM LYLE GALBRAITH,
Secretary.

Chief Office:
Horseferry Road,
Westminster, S.W. 1,
May 15, 1936.

THE MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE PROPRIETORS.

NOTICE is Hereby Given that an ORDINARY GENERAL MEETING of the Proprietors of the Company will be held at the Offices, 5, Great Winchester Street, Old Broad Street, London, E.C. 2, on Tuesday, 2nd June, 1936, at Twelve o'clock noon, to receive the Report of the Directors and the Accounts for the Year ended 31st March, 1936; to declare Dividends; to elect Auditors and to fix their remuneration; and to transact the General Business of the Company.

One of the Directors, ARTHUR MATTHEWS PADDON, M.INST.C.E., retires from office, and offers himself for re-election.

The Auditors, Mr. WILLIAM CASH, F.C.A., and Mr. HYDE CLARKE BURTON, F.C.A., retire, and offer themselves for re-election.

The TRANSFER BOOKS WILL BE CLOSED from the 20th day of May until the day of the Meeting, both days inclusive.

By order of the Board,
G. MURRAY BURTON,
Secretary.

5, Great Winchester Street,
Old Broad Street, E.C. 2,
May 5, 1936.